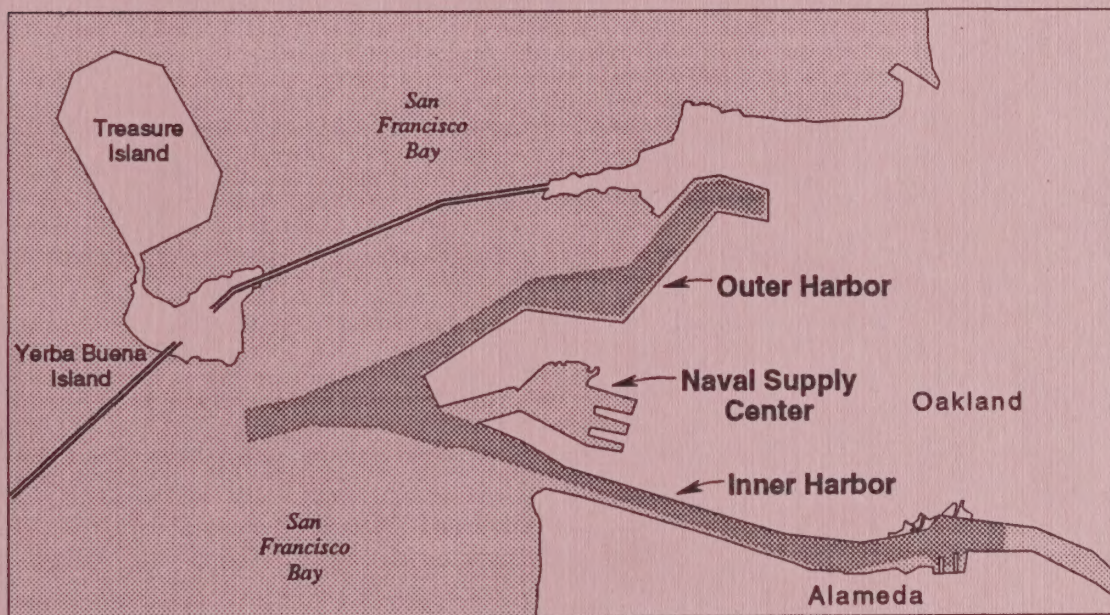


7/12/94

Final Supplemental Environmental Impact Report/ Environmental Impact Statement Oakland Harbor Deep-Draft Navigation Improvements

SCH 91073031

*Prepared by*

**U.S. Army Corps of Engineers
San Francisco District**

Federal Lead Agency

Port of Oakland

State Lead Agency

June 1994



PORT OF OAKLAND



**US Army Corps
of Engineers**

San Francisco District

**NOTICE OF AVAILABILITY
FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT/STATEMENT (SEIR/S)
OAKLAND HARBOR DEEP-DRAFT NAVIGATION IMPROVEMENTS**

Notice is hereby given that a Final Supplemental Environmental Impact Report/Statement (SEIR/S) has been prepared by the Port of Oakland and the Corps of Engineers, San Francisco District to evaluate the impacts associated with the proposed Oakland Harbor Deep-Draft Navigation Improvements. The project consists of deepening the Oakland Inner and Outer Harbors (cities of Oakland, Alameda, and San Francisco) to the authorized depth of -42 feet (MLLW) to accommodate deep-draft ships. The document evaluates the impacts associated with the disposal of an estimated 6.6 million cubic yards of dredged material to be excavated from the Harbor channels and berthing areas. The selected plan consists of dredging the harbor channels and berthing areas and the disposal of these sediments as follows:

- 2.9 or more million cubic yards of dredged sediments in the Pacific ocean at a site to be designated by the U.S. Environmental Protection Agency,
- Up to 2.5 million cubic yards of sediments at the proposed Sonoma Baylands wetlands restoration project in southern Sonoma County, and
- Up to 1.2 million cubic yards of sediments at the site of the Galbraith Golf Course in the City of Oakland (Alameda County). A small portion of the material presently proposed for disposal at the Galbraith site may be disposed at a landfill if required by the Regional Water Quality Control Board.

The dredging of the Port's berth areas (an estimated 192,000 cubic yards) with land and aquatic disposal of these sediments requires an Army Corps of Engineers permit pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), Section 404 of the Clean Water Act (33 U.S.C. 1344), and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 U.S.C. 1413). The SEIR/S fulfills the National Environmental Policy Act requirements for the Corps' permit decision. This Notice of Availability also constitutes the Public Notice for the permit application (the SEIR/S provides a detailed project description) with the comment period as described below.

DOCUMENT AVAILABILITY

If you wish to receive a copy of the Final SEIR/S for review, please call Mr. Roger Golden at the Corps of Engineers at (415) 744-3344. Copies of the documents are also available for public review at the following locations:

Corps of Engineers
San Francisco District
Environmental Branch
211 Main Street
San Francisco, CA 94105
(415) 744-3344

Port of Oakland
Environmental Department
530 Water Street
Oakland, CA 94607
(510) 272-1174

Oakland Public Library
Science/Business/Sociology
125 14th Street
Oakland, CA 94607
(510) 238-3138

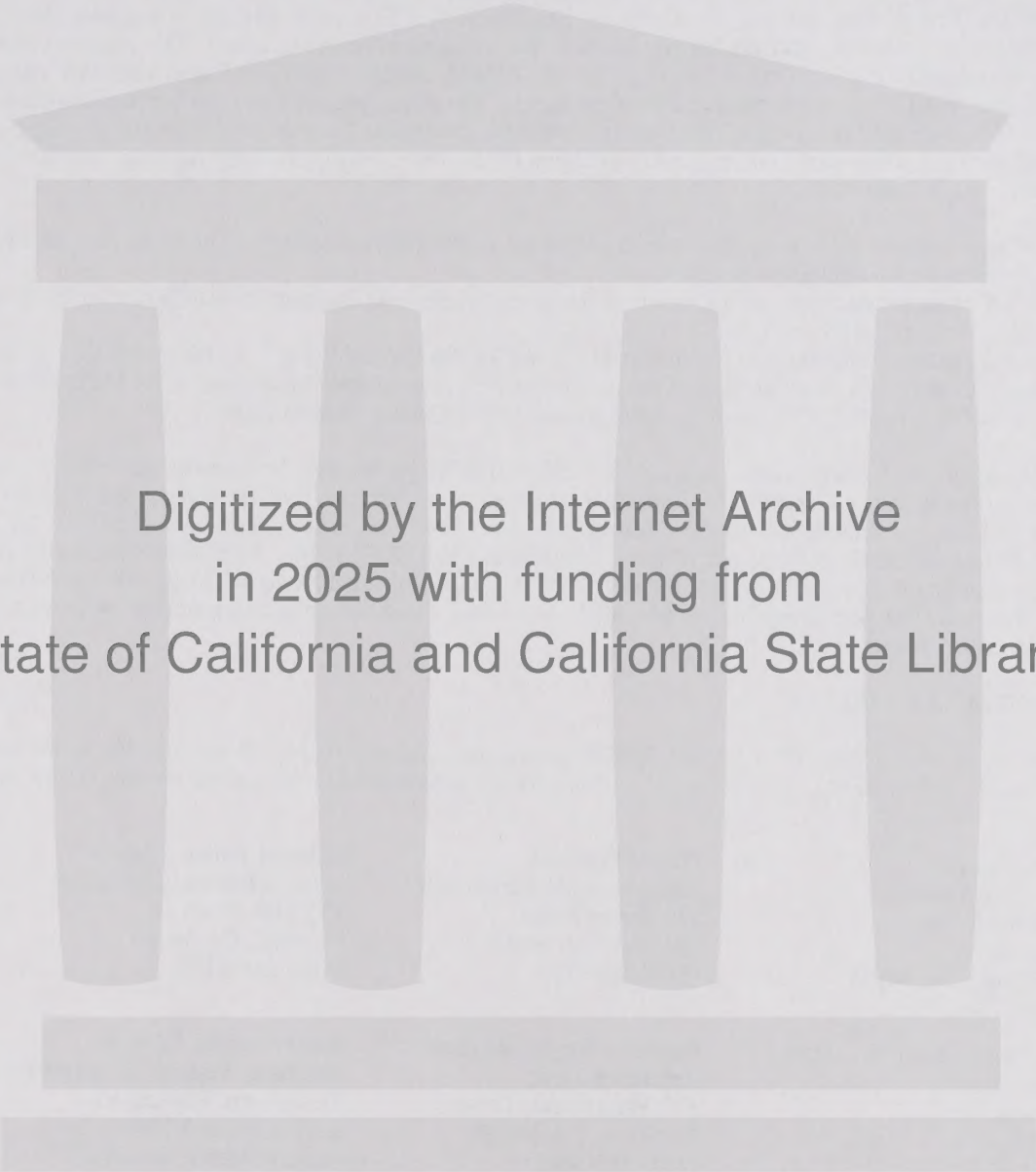
Sonoma County Central Library
Reference Desk
3rd and E Street
Santa Rosa, CA
(707) 545-0831

Petaluma Regional Library
Reference Desk
100 Fairgrounds Drive
Petaluma, CA 94952
(707) 763-9801

San Francisco Library
Business, Science, & Government
Documents Department
Larkin & McAllister
San Francisco, CA 94102
(415) 557-4488

COMMENT PERIOD

The Port of Oakland and Corps of Engineers will consider comments upon information contained in the Final SEIR/S. The comment period on the Final SEIR/S is 30 days following notice of the document in the July 1, 1994 Federal Register. All comments must be received by either the Port of Oakland Environmental Department (Attention: Jody Zaitlin) or the Corps of Engineers Environmental Branch (Attention: Roger Golden) at the addresses listed above during the Public Review Period, which ends at 5:00 p.m., August 1, 1994.



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**Final Supplemental
Environmental Impact Report/
Environmental Impact Statement
Oakland Harbor Deep-Draft
Navigation Improvements**

SCH 91073031

Prepared by

**U.S. Army Corps of Engineers
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S. SUMMARY

S.1 INTRODUCTION

Several Environmental Impact Statements (EISs) and Environmental Impact Reports (EIRs) have been prepared on previous dredging projects in Oakland Harbor, California (Corps of Engineers [COE] 1979, 1984, 1988; Port of Oakland [Port] 1988, 1989). This Supplemental Environmental Impact Report/Statement (SEIR/S) analyzes the impacts associated with the proposed deepening of Oakland Harbor to accommodate deep-draft ships. Since the impacts of dredging in the harbor have been well documented in the previous EISs, this document focuses on the impacts associated with the disposal of the dredged material. This document fulfills the requirements of the National Environmental Policy Act (NEPA) to support decisionmaking on Federal civil works projects, and the California Environmental Quality Act (CEQA) requirements for state decisions related to the project.

Construction of the proposed navigation improvements to Oakland Harbor in Alameda County, California, was authorized by the Water Resources Development Act of 1986. The Port of Oakland is the non-Federal (local) sponsor of the Federal project. The harbor channels have been determined to be no longer adequate to efficiently and cost-effectively accommodate modern deep-draft vessels. The objectives of the proposed deepening project are to reduce tidal-caused delays associated with containership passages, to increase economies of scale for waterborne commerce, and to increase navigational safety. The authorized project would provide national benefits through reducing vessel delays due to tides, by deepening and widening the channel, and would reduce the potential for vessel collisions and groundings. The proposed deepening would also increase the Port's ability to take advantage of economies of scale benefits.

S.2 AREAS OF CONTROVERSY AND CONCERN

Public concerns have been identified in the Notice of Intent (NOI) and Notice of Preparation (NOP) process and at scoping meetings held to receive public input on the scope of this environmental analysis. Disposal-related concerns include: sediment suitability for various disposal sites and uses; impacts on natural resources (e.g., biology, water quality) at the ocean, in-Bay, and upland disposal sites; socioeconomic concerns (e.g., impacts on commercial and recreational fisheries, and other recreational resources); methods for identifying and screening disposal alternatives; and the cumulative impacts of the proposed project with all the projects encompassed by the interagency Long-Term Management Strategy (LTMS) for dredging and disposal in the Bay Area over the next 50 years. Additional details on public concerns are provided in Chapter 13.

S.3 MAJOR CONCLUSIONS

S.3.1 Description of Proposed Action

The proposed channel and berth improvements would involve the dredging and disposal of approximately 6.6 million cubic yards (mcy), primarily from channel bottom sediments but also from berth bottom and bank sediments. The quality of the sediments to be dredged has been sampled and categorized in terms of its suitability for various disposal options (e.g., ocean, in-Bay, cover and non-cover uses in a wetland, confinement in a landfill); the criteria used to make these determinations are explained in section 2.4.

Summary

The proposed dredging and disposal project is anticipated to begin in December 1994 and last for 24 to 27 months. The improvements would include Channel deepening to -42 feet mean lower low water (MLLW), plus a maximum of 1-foot of allowable overdepth, due to the inaccuracies of the dredging process, from -35 feet MLLW for the Outer Harbor and parts of the Inner Harbor, and from -38 feet MLLW for most of the Inner Harbor. Approximately 3.4 miles of the Outer Harbor and 4.0 miles of the Inner Harbor would be dredged. Other ancillary improvements include construction of a new turning basin in the Inner Harbor; deepening of vessel berthing areas to -42 feet MLLW; relocation of submarine utilities; and removal of existing pier structures in the project vicinity. The need to maintain the proposed project once constructed, and the estimated maintenance dredging volumes from the improved channels are included in this environmental document. Subsequent maintenance dredging of the deepened channels and berths will be controlled by existing regulatory authorities and procedures.

Disposal of the sediment has been controversial in the Bay Area. As originally authorized, disposal of Oakland Harbor sediment was to be at the historical and currently used aquatic site identified by the Environmental Protection Agency (EPA) as SF-11, located near Alcatraz Island in central San Francisco Bay. Other disposal sites are being considered with the proposed project because of (1) the mounding of dredged material disposed at Alcatraz; (2) public concern about the impact of large-scale disposal on the resources of the Bay; and (3) recently implemented restrictions on the volume of dredged material that may be disposed at Alcatraz. Twenty-three (23) dredged material disposal sites were initially considered. These were subsequently narrowed down to eight sites, including aquatic sites (an ocean and in-Bay sites) and upland sites, which are analyzed in detail in this document. Since only one of the eight sites could accept the full volume of dredged material, they were combined in different ways into 12 dredged material disposal project alternatives. The 12 project alternatives were then compared to identify the environmentally preferred alternative.

S.3.2 Rationale for Selection of the Recommended Plan/Proposed Action

The Recommended Plan (also called the Selected Plan in this document) is based on the least-cost, environmentally acceptable plan that also includes habitat (wetland) restoration. The habitat restoration benefits of the least-cost plan would result in a substantial increase in wetland habitat of national importance. In accordance with Section 907 of the Water Resources Development Act (WRDA) of 1986, monetary benefits attributable to measures included in a project for the purpose of habitat restoration or enhancement shall be deemed to be at least equal to the costs of such measures.

Given the provision of WRDA 1986 (i.e., benefits exceed costs for justifiable habitat restoration), the selected plan is dredged material disposal Alternative B2 (i.e., ocean, Sonoma Baylands, Galbraith and, if required, Port/Landfill). Alternative B2 is the least-cost habitat restoration plan, and is therefore designated as the National Economic Development (NED) plan.

S.3.3 Alternatives Analysis and Comparative Impacts of Alternatives

Twenty-three (23) disposal sites were initially considered for the dredged materials. Fifteen (15) of these were subsequently dropped from further consideration in this SEIR/S, and the remaining eight were analyzed in detail. Since only one of the eight disposal sites could accommodate the total volume of dredged sediment (6.6 mcy), due to either site capacity limitations or site restrictions because of sediment quality, they were grouped together in different combinations to develop 12 project alternatives. The project alternatives thus represent different combinations of the eight disposal sites. Each dredged

material disposal alternative is composed of one to three disposal sites. The alternatives can be grouped into five main categories, as listed below.

- Maximum Ocean Disposal
- Maximum Wetland Restoration
- All Upland Disposal
- Maximum Confined In-Bay Aquatic Disposal
- Maximum Unconfined In-Bay Aquatic Disposal

These dredged material disposal alternatives are described in section 2.8. A comparison of the impacts of the alternatives by resource is provided in Table S-1. The significant environmental impacts of each alternative are summarized in section S.3.4 and described in detail in Appendix G. Chapter 6, which compares the impacts of the alternatives, includes a repeat of Table S-1.

S.3.4 Comprehensive Summary of Impacts

The significant impacts of, and associated mitigation measures for, the 12 disposal alternatives are summarized in Table S-2. Note that this table discusses only the significant or potentially significant impacts; adverse but insignificant impacts, which are not included in this table, are discussed in chapters 4 and 5.

S.4 ENVIRONMENTAL (MITIGATION) COMMITMENTS

The mitigation and monitoring plan for the selected plan has been prepared and is included as Appendix J to this document. Responsibilities for implementation of each mitigation measure as required by CEQA and NEPA, are detailed in Appendix J.

S.5 ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is Alternative B2, maximum wetland restoration. It would involve use of the ocean site, Sonoma Baylands, Galbraith Golf Course and, if required by the RWQCB, the Port/Landfill disposal option. This alternative is described in section 2.8, its impacts are compared to the other alternatives in Chapter 6, and described in detail in Appendix G.

S.6 RELATIONSHIP TO ENVIRONMENTAL PROTECTION STATUTES, PLANS, AND OTHER REQUIREMENTS

Table S-3 summarizes the dredged material disposal sites' compliance with environmental requirements. This table also appears in section 2.9 where the environmental requirements listed in the table are described.

Table S-1. Comparison of Project Alternatives¹
(page 1 of 2)

Project Component	Air Quality	Water Resources	Geology and Soils	Biological Resources	Cultural Resources	Noise	Transportation	Land Use²	Plans and Policies³	Human Health Risk
Dredging Activity	-3	-1	0/+2	-1	0	0	+2	-0	+	-0
No-Action Alternative	0	0	0	0	0	0	0/+1	-3	-	-0
Maximum Ocean Disposal										
A1. Ocean, Galbraith	-3	-2	-2	-2	-0	-2	-0	-3	+	-1
A2. Ocean, Leonard	-3	-2	-2	-2	-1	-1	-2	-3	-	-1
Maximum Wetland Restoration										
B1. Ocean, Montezuma, Port	-3	-2	-2	-3/+2	-2	-2	-0	-1/+1	+	-1
B2. Ocean, Sonoma, Galbraith	-3	-2	-2	-2/+2	-0	-2	-0	-3	+	-1
B3. Ocean, Leonard, Sonoma	-3	-2	-2	-2/+2	-1	-1	-2	-3	-	-1
All Upland Disposal										
C1. Galbraith, Montezuma	-3	-2	-2	-3/+2	-2	-2	-0	-3/+1	+	-1
C2. Leonard, Montezuma	-3	-2	-2	-3/+2	-2	-2	-2	-3/+1	-	-1
D1. Maximum Confined Aquatic Disposal Borrow Area	-3	-2	-1	-1	-0	-1	-0	-1	-	-1
Maximum In-Bay Unconfined Aquatic Disposal										
E1. Ocean, Alcatraz, Galbraith	-3	-2	-2	-2	-0	-2	-0	-3	-	-1
E2. Ocean, BFBA, Galbraith	-3	-2	-2	-2	-0	-2	-0	-3	-	-1
E3. Ocean, Alcatraz, Leonard	-3	-2	-2	-2	-1	-1	-2	-3	-	-1
E4. Ocean, BFBA, Leonard	-3	-2	-2	-2	-1	-1	-2	-3	-	-1

Table S-1. Comparison of Project Alternatives¹
(page 2 of 2)

Notes

1. A number preceded by a minus sign (-) is an adverse impact. A number preceded by a plus sign (+) is a beneficial impact. A slash mark (/) separates an adverse impact from a beneficial impact.

For adverse impacts: 3 = significant and unavoidable adverse impact
 2 = significant but mitigable adverse impact
 1 = adverse but not significant impact
 0 = negligible or no impact

For beneficial impacts: 2 = significant beneficial impact

2. Land use refers to actual physical impacts (e.g., loss of recreational uses or loss of prime farmland).
3. For plans and policies, the plus (+) or minus (-) in the table refers to potential consistency or inconsistency with existing applicable land uses plans and policies. A plus (+) = consistency with plans and policies, a minus (-) = potential inconsistency.

Table S-2. Summary of Potentially Significant Impacts
(page 1 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative A1. Maximum Ocean Disposal				
Ocean, Galbraith	Air Quality	Exceedance of AQMD emission thresholds for (1) one percent of combined Counties' emissions of NO_x and (2) BACT thresholds for all pollutants from dredging and transport equipment. Excessive fugitive dust generation at Galbraith sites during sediment drying.	Retard injection timing of diesel-powered equipment for NO_x control and use of reformulated diesel fuel for TOG/ROG and SO₂ control. When necessary, apply a soil binding agent, such as water, during construction or when large amounts of bare soil are exposed. When necessary, cover trucks with tarpaulins or use an equivalent method.	SO₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance. Insignificant.
Ocean, Galbraith	Hydrology	At the Galbraith site, significant impacts on groundwater quality could occur, due to the lateral migration of existing leachate fluids containing petroleum products. At the Galbraith site, data show that discharge of surface water may exceed water quality objectives. Additionally, data may not adequately predict potential water quality impacts. Placement on the Galbraith site of sediments containing elevated levels of contaminants exceeding levels acceptable to the RWQCB.	Design containment structures to meet RWQCB requirements. Vegetative control areas will be placed outside of the drying ponds to increase sedimentation and provide natural treatment for metals. Effluent monitoring will show whether RWQCB standards are being met. If standards are not met, decant water can be held in the ponds for an extended period. The Port will conduct additional sampling after the dredged material dries to confirm that there are no "hot spots" present.	Insignificant. Insignificant. Insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 2 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative A1. Maximum Ocean Disposal				
Ocean, Galbraith	Geology, Soils, and Seismicity	If a large magnitude earthquake occurred on a nearby fault, earthquake-induced levee failure at the Galbraith Site could cause geologic hazards on surrounding features such as Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.
Ocean, Galbraith	Biological Resources	At Galbraith, there would be a loss of approximately 3.7 acres of seasonal freshwater marsh, tidal wetlands, and other waters of the U.S. (exact acreage to be determined by the Corps).	Avoidance to extent possible; on-site creation of wetland habitat to offset losses at a ratio of 1.1:1 to 1.3:1.	Insignificant.
		At Galbraith, potential impacts on burrowing owls if present, a species of special concern.	If active burrows are identified during a pre-construction survey, owls and burrows will be relocated off site.	Insignificant.
		At Galbraith, seasonal ponding may increase mosquitos.	Consult with Alameda County Mosquito Abatement District.	Insignificant.
		At Galbraith, disturbance of aquatic biota by pipeline construction and pumping operations; potential impacts from fuel spills or a break in slurry pipeline.	Set anchors for the duration of the project; careful handling of fuel; install leak detection system on the pipe and/or monitor slurry discharge.	Insignificant.
Ocean, Galbraith	Noise	At the Galbraith site, the unloader and booster pumps could cause excessive noise, depending on their placement.	Locate pumps or muffle pumps so that noise does not exceed 60 dBA between 7 A.M. and 10 P.M. and 50 dBA between 10 P.M. and 7 A.M.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 3 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/ Mitigation
Alternative A1. Maximum Ocean Disposal				
Ocean, Galbraith	Land Use	Loss of golfing recreational uses during the 7-year interim construction phase at the Galbraith Golf Course.	Allow for continuance of youth golfing program. Subsidize senior golf clubs, and Oakland senior use of nearby golf course. A new golf course would be provided at the end of the dredged sediment drying phase.	Significant (during construction only).
		Loss of municipal soccer field on Galbraith Golf Course site.	The City of Oakland will construct a new soccer field at the Curt Flood Sports Complex in East Oakland.	Insignificant.
Alternative A2. Maximum Ocean Disposal				
Ocean, Leonard/Redwood	Air Quality	Exceedance of AQMD emission thresholds for (1) one percent of combined Counties' emissions of NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance.
		Excessive fugitive dust generation from exposed soil at Leonard/ Redwood.	Apply water to exposed soil, as needed, to minimize dust emissions.	Insignificant.
Ocean, Leonard/Redwood	Geology, Soils, and Seismicity	At the Leonard Ranch site, earthquake-induced levee failure at the site could cause geologic hazards on Highway 37 and the adjacent railroad tracks, if a large magnitude earthquake occurred on a nearby fault.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 4 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative A2. Maximum Ocean Disposal				
Ocean, Leonard/Redwood	Biological Resources	At the Leonard Ranch site, loss or replacement of up to 31 acres of wetlands.	On-site creation of wetlands to offset losses. Off-site wetland creation or restoration at a 4:1 ratio.	Insignificant.
		At the Leonard Ranch site, disturbance of sensitive bird species (e.g., California clapper rail) nesting in salt marsh along San Pablo Bay.	Conduct preconstruction nesting surveys for sensitive bird species; avoid construction within 500 feet of active nests during the nesting season (Feb 1-Aug 31).	Insignificant.
Ocean, Leonard/Redwood	Cultural Resources	Potential for encountering unrecorded resources on Leonard Ranch/Redwood Landfill during construction.	Perform intensive survey by qualified archaeologists. If cultural resources are identified and unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.
Ocean, Leonard/Redwood	Transportation	Trucking dredged material to the Redwood Landfill would increase risk of accidents and congestion.	Avoid peak hours.	Insignificant.
Ocean, Leonard/Redwood	Land Use	The containment levee at Leonard Ranch would partially obstruct scenic views of the bay plain.	Increase the setback of the containment levee from SR 37 to reduce obstruction.	Impacts reduced but may not be insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 5 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative B1. Maximum Wetland Restoration				
Ocean, Montezuma, Port/Landfill	Air Quality	Exceedance of AQMD emission thresholds for (1) one percent of combined Counties' emissions of NO_x and (2) BACT thresholds for all pollutants from dredging and transport equipment. Excessive fugitive dust generation from exposed soil at upland sites.	Retard injection timing of diesel-powered equipment for NO_x control and use of reformulated diesel fuel for TOG/ROG and SO₂ control. Apply water to exposed soil, as needed, to minimize dust emissions.	SO₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance. Insignificant.
Ocean, Montezuma, Port/Landfill	Geology, Soils, and Seismicity	If a large magnitude earthquake occurred on a nearby fault, potential earthquake-induced levee failure at the Montezuma Wetlands site could cause geologic hazards on Fire Truck or Dinkelspiel Roads, if a levee were constructed near the roads.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.
Ocean, Montezuma, Port/Landfill	Biological Resources	Use of Phase I of the Montezuma Wetlands site would eliminate 576 acres of existing, on-site jurisdictional wetlands (predominantly grasslands) and waters of the U.S., and would allow eventual reestablishment of tidal wetlands, providing wetland creation is successful; could result in uptake of contaminants by resident plants and transference into the food chain; would result in loss of and possible additional degradation of vernal pools; cause potential losses of habitat and population for sensitive plant species (impacts not fully defined); cause loss of foraging habitat for raptors; loss of habitat for sensitive bird, amphibian, and reptile species; and may have unknown impacts on state and federally listed sensitive fish species.	Solano County and the Section 404 permit approval of the Montezuma Wetlands site would require mitigations to lessen or offset project impacts. Mitigations identified by Solano County (1993) include specifications for revegetation, dredged material, and site design that will enhance tidal marsh restoration; construction of a 10-acre pilot project to determine whether contaminated spoils would be hazardous to wildlife; replacement and avoidance of damage to vernal pools; surveys for sensitive plant and wildlife species followed by design and implementation of species-specific mitigation plans as required by state and federal agencies; creation or restoration of on-site habitat for raptors, including burrowing owls; monitoring of sensitive fish populations; and preparation of a mosquito abatement plan.	Potentially significant; feasibility and effectiveness of mitigations are unknown.

Table S-2. Summary of Potentially Significant Impacts
(page 6 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative B1. Maximum Wetland Restoration				
Ocean, Montezuma, Port/Landfill	Cultural Resources	On Montezuma Wetlands, two historic archaeological sites would be impacted by restoration ground disturbances. Potential for unrecorded resources to be encountered during construction.	Design dredged material disposal to avoid all known prehistoric and historic resources, including a 50-foot buffer surrounding archaeological artifact scatters. If resources are unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps of Engineers, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.
Ocean, Montezuma, Port/Landfill	Noise	At the Montezuma Wetlands site, pumps would cause excessive noise.	Install "critical" grade silencers; partially or completely enclose pumps.	Insignificant.
Alternative B2. Maximum Wetland Restoration				
Ocean, Sonoma, Galbraith	Air Quality	Exceedance of AQMD emission thresholds for (1) one percent of combined Counties' emissions of NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance.
		Excessive fugitive dust generation from exposed soil at the upland sites.	When necessary, apply a soil binding agent, such as water, during construction or when large amounts of bare soil are exposed. When necessary, cover trucks with tarpaulins or use an equivalent method.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 7 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative B2. Maximum Wetland Restoration				
Ocean, Sonoma, Galbraith	Hydrology	At the Galbraith site, significant impacts on groundwater quality due to the lateral migration of existing leachate fluids containing petroleum products.	Design containment structures to meet RWQCB requirements.	Insignificant.
		At the Galbraith site, data show that discharge of surface water may exceed water quality objectives. Additionally, data may not adequately predict potential water quality impacts.	Vegetative control areas will be placed outside of the drying ponds to increase sedimentation and provide natural treatment for metals. Effluent monitoring will show whether RWQCB standards are being met. If standards are not met, decant water can be held in the ponds for an extended period.	Insignificant.
		Placement on the Galbraith site of sediments containing elevated levels of contaminants exceeding levels acceptable to the RWQCB.	The Port will conduct additional sampling after the dredged material dries to confirm that there are no "hot spots" present.	Insignificant.
Ocean, Sonoma, Galbraith	Geology, Soils, and Seismicity	If a large magnitude earthquake occurred on a nearby fault, earthquake-induced levee failure at the Galbraith site could cause geologic hazards on surrounding features such as Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 8 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative B2. Maximum Wetland Restoration				
Ocean, Sonoma, Galbraith	Biological Resources	At Sonoma Baylands, loss of 56.3 acres of seasonal freshwater and brackish wetlands.	On-site creation of tidal wetlands to offset losses.	Insignificant.
		Disturbance of sensitive bird species nesting in salt marsh along San Pablo Bay.	Conduct preconstruction surveys for sensitive species; reschedule or relocate potentially disturbing activities during the nesting season (February through August) away from nesting areas.	Insignificant.
		At Sonoma Baylands, noise caused by unloading and booster pump operations may disturb special-status wildlife.	Muffle and/or enclose pumps to limit noise levels to less than 65 dBA at 50 feet from the pump.	Insignificant.
		At Galbraith, loss of approximately 3.7 acres of seasonal freshwater marsh, tidal wetlands, and other waters of the U.S. (exact acreage to be determined by the Corps).	Avoidance to extent possible; on-site creation of wetland habitat to offset losses at a ratio of 1.1:1 to 1.3:1.	Insignificant.
		At Galbraith, potential impacts on burrowing owls if present, a species of special concern.	If active burrows are identified during a pre-construction survey, owls and burrows will be relocated off site.	Insignificant.
		At Galbraith, seasonal ponding may increase mosquitos.	Consult with Alameda County Mosquito Abatement District.	Insignificant.
		At Galbraith and Sonoma, disturbance of aquatic biota by pipeline construction and pumping operations; potential impacts from fuel spills or a break in slurry pipeline.	Set anchors for the duration of the project; careful handling of fuel; install leak detection system on the pipe and/or monitor slurry discharge.	Insignificant.
Ocean, Sonoma, Galbraith	Noise	At the Galbraith site, the unloader and booster pumps could cause excessive noise, depending on their placement.	Locate or muffle pumps so that noise does not exceed 60 dBA between 7 A.M. and 10 P.M. and 50 dBA between 10 P.M. and 7 A.M.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
(page 9 of 25)

Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/ Mitigation
Alternative B2. Maximum Wetland Restoration				
Ocean, Sonoma, Galbraith	Land Use	Loss of golfing recreational uses during the 7-year interim construction phase at the Galbraith Golf Course.	Allow for continuance of youth golfing program. Subsidize senior golf clubs, and Oakland senior use of nearby golf course. A new golf course would be provided at the end of the dredged sediment drying phase.	Significant (during construction only).
		Loss of municipal soccer field on Galbraith Golf Course site.	The City of Oakland will construct a new soccer field at the Curt Flood Sports Complex in East Oakland.	Insignificant.
Alternative B3. Maximum Wetland Restoration				
Ocean, Leonard/ Redwood, Sonoma	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' emissions NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control.	NO _x emissions reduced to below 1 percent of combined Counties NO _x emissions. SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance.
		Excessive fugitive dust generation from exposed soil at upland sites.	Apply water to exposed soil, as needed, to minimize dust emissions.	Insignificant.
Ocean, Leonard/ Redwood, Sonoma	Geology, Soils, and Seismicity	At the Leonard Ranch site, earthquake-induced levee failure at the site could cause geologic hazards on SR 37 and the adjacent railroad tracks, if a large magnitude earthquake occurred on a nearby fault.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative B3. Maximum Wetland Restoration				
Ocean, Leonard/Redwood, Sonoma	Geology, Soils, and Seismicity (cont.)	If a large magnitude earthquake occurred on a nearby fault, potential earthquake-induced levee failure at the Montezuma Wetlands site could cause geologic hazards on Fire Truck or Dinkelspiel Roads, if a levee were constructed near the roads.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.
Ocean, Leonard/Redwood, Sonoma	Biological Resources	At Sonoma Baylands, loss of 56.3 acres of seasonal freshwater and brackish wetlands.	On-site creation of tidal wetlands to offset losses.	Insignificant.
		Disturbance of sensitive bird species nesting in salt marsh along San Pablo Bay.	Conduct preconstruction surveys for sensitive species; reschedule or relocate potentially disturbing activities during the nesting season (February through August) away from nesting areas.	Insignificant.
		At Sonoma Baylands, noise caused by unloading and booster pump operations may disturb special-status wildlife.	Muffle and/or enclose pumps to limit noise levels to less than 65 dBA at 50 feet from the pump.	Insignificant.
		Disturbance of sensitive bird species nesting in salt marsh along San Pablo Bay.	Conduct preconstruction surveys for sensitive species; reschedule or relocate potentially disturbing activities during the nesting season (February through August) away from nesting areas.	Insignificant.
		At Leonard Ranch, loss or replacement of up to 31 acres of wetlands.	On-site creation of wetlands to offset losses. Off-site wetland creation or restoration at a 4:1 ratio.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative B3. Maximum Wetland Restoration				
Ocean, Leonard/Redwood, Sonoma	Cultural Resources	Potential for encountering unrecorded sources on Leonard Ranch/Redwood Landfill during construction.	Perform intensive survey by qualified archaeologists. If cultural resources are identified and unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.
Ocean, Leonard/Redwood, Sonoma	Transportation	Trucking dredged material to the Redwood Landfill would increase risk of accidents and congestion.	Avoid peak hours.	Insignificant.
Ocean, Leonard/Redwood, Sonoma	Land Use	The containment levee at Leonard Ranch would partially obstruct scenic views of the bay plain.	Increase the setback of the containment levee from SR 37 to reduce obstruction.	Impacts reduced but may not be insignificant.
Alternative C1. All Upland Disposal				
Galbraith, Montezuma	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' NO_x emissions and (2) BACT thresholds for all pollutants from dredging and transport equipment. Excessive fugitive dust generation from exposed soil at upland sites.	Retard injection timing of diesel-powered equipment for NO_x control and use of reformulated diesel fuel for TOG/ROG and SO₂ control. When necessary, apply a soil binding agent, such as water, during construction or when large amounts of bare soil are exposed. When necessary, cover trucks with tarpaulins or use an equivalent method.	SO₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance. Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative C1. All Upland Disposal				
Galbraith, Montezuma	Hydrology	At the Galbraith site, significant impacts on groundwater quality due to the lateral migration of existing leachate fluids containing petroleum products.	Design containment structures to meet RWQCB requirements.	Insignificant.
		At the Galbraith site, data show that discharge of surface water may exceed water quality objectives. Additionally, data may not adequately predict potential water quality impacts.	Vegetative control areas will be placed outside of the drying ponds to increase sedimentation and provide natural treatment for metals. Effluent monitoring will show whether RWQCB standards are being met. If standards are not met, decant water can be held in the ponds for an extended period.	Insignificant.
		Placement on the Galbraith site of sediments containing elevated levels of contaminants exceeding levels acceptable to the RWQCB.	The Port will conduct additional sampling after the dredged material dries to confirm that there are no "hot spots" present.	Insignificant.
Galbraith, Montezuma	Geology, Soils, and Seismicity	If a large magnitude earthquake occurred on a nearby fault, earthquake-induced levee failure at the Galbraith Site could cause geologic hazards on surrounding features such as Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative C1. All Upland Disposal				
Galbraith, Montezuma	Biological Resources	At Galbraith, there would be a loss of approximately 3.7 acres of seasonal freshwater marsh, tidal wetlands, and other waters of the U.S. (exact acreage to be determined by the Corps).	Avoidance to extent possible; on-site creation of wetland habitat to offset losses at a ratio of 1.1:1 to 1.3:1.	Insignificant.
		At Galbraith, potential impacts on burrowing owls if present, a species of special concern.	If active burrows are identified during a pre-construction survey, owls and burrows will be relocated off site.	Insignificant.
		At Galbraith, seasonal ponding may increase mosquitos.	Consult with Alameda County Mosquito Abatement District.	Insignificant.
		At Galbraith, disturbance of aquatic biota by pipeline construction and pumping operations; potential impacts from fuel spills or a break in slurry pipeline.	Set anchors for the duration of the project; careful handling of fuel; install leak detection system on the pipe and/or monitor slurry discharge.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative C1. All Upland Disposal				
Galbraith, Montezuma	Biological Resources (cont.)	Use of Phase I of the Montezuma Wetlands site would eliminate 576 acres of existing, on-site jurisdictional wetlands (predominantly grasslands) and waters of the U.S., and would allow eventual reestablishment of tidal wetlands, providing wetland creation is successful; could result in uptake of contaminants by resident plants and transference into the food chain; would result in loss of and possible additional degradation of vernal pools; cause potential losses of habitat and population for sensitive plant species (impacts not fully defined); cause loss of foraging habitat for raptors; loss of habitat for sensitive bird, amphibian, and reptile species; and may have unknown impacts on state and federally listed sensitive fish species.	Solano County and the Section 404 permit approval of the Montezuma Wetlands site would require mitigations to lessen or offset project impacts. Mitigations identified by Solano County (1993) include specifications for revegetation, dredged material, and site design that will enhance tidal marsh restoration; construction of a 10-acre pilot project to determine whether contaminated spoils would be hazardous to wildlife; replacement and avoidance of damage to vernal pools; surveys for sensitive plant and wildlife species followed by design and implementation of species-specific mitigation plans as required by state and federal agencies; creation or restoration of on-site habitat for raptors, including burrowing owls; monitoring of sensitive fish populations; and preparation of a mosquito abatement plan.	Potentially significant; feasibility and effectiveness of mitigations are unknown.
Galbraith, Montezuma	Cultural Resources	On Montezuma Wetlands, two historic archaeological sites would be impacted by restoration ground disturbances. Potential for unrecorded resources on Montezuma Wetlands and Galbraith to be encountered during construction.	Design dredged material disposal to avoid all known prehistoric and historic resources, including a 50-foot buffer surrounding archaeological artifact scatters. If cultural resources are identified and unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative C1. All Upland Disposal				
Galbraith, Montezuma	Noise	At the Montezuma Wetlands site, pumps would cause excessive noise.	Install "critical" grade silencers; partially or completely enclose pumps.	Insignificant.
		At the Galbraith site, the unloader and booster pumps could cause excessive noise, depending on their placement.	Locate or muffle pumps so that noise does not exceed 60 dBA between 7 A.M. and 10 P.M. and 50 dBA between 10 P.M. and 7 A.M.	Insignificant.
Galbraith, Montezuma	Land Use	Loss of golfing recreational uses during the 7-year interim construction phase at the Galbraith Golf Course.	Allow for continuance of youth golfing program. Subsidize senior golf clubs, and Oakland senior use of nearby golf course. A new golf course would be provided at the end of the dredged sediment drying phase.	Significant (during construction only).
		Loss of municipal soccer field on Galbraith Golf Course site.	The City of Oakland will construct a new soccer field at the Curt Flood Sports Complex in East Oakland.	Insignificant.
Alternative C2. All Upland Disposal				
Leonard/Redwood, Montezuma	Air Quality	Exceedance of AQMD BACT emission thresholds for all pollutants from dredging and transport equipment.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance.
		Excessive fugitive dust generation from exposed soil at upland sites.	Apply water to exposed soil, as needed, to minimize dust emissions.	Insignificant.
Leonard/Redwood, Montezuma	Biological Resources	At Leonard Ranch, loss or replacement of up to 31 acres of wetlands.	On-site creation of wetlands to offset losses. Off-site wetland creation or restoration at a 4:1 ratio.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative C2. All Upland Disposal				
Leonard/Redwood, Montezuma	Biological Resources (cont.)	Use of Phase I of the Montezuma Wetlands site would eliminate 576 acres of existing, on-site jurisdictional wetlands (predominantly grasslands) and waters of the U.S., and would allow eventual reestablishment of tidal wetlands, providing wetland creation is successful; could result in uptake of contaminants by resident plants and transference into the food chain; would result in loss of and possible additional degradation of vernal pools; cause potential losses of habitat and population for sensitive plant species (impacts not fully defined); cause loss of foraging habitat for raptors; loss of habitat for sensitive bird, amphibian, and reptile species; and may have unknown impacts on state and federally listed sensitive fish species.	Solano County and the Section 404 permit approval of the Montezuma Wetlands site would require mitigations to lessen or offset project impacts. Mitigations identified by Solano County (1993) include specifications for revegetation, dredged material, and site design that will enhance tidal marsh restoration; construction of a 10-acre pilot project to determine whether contaminated spoils would be hazardous to wildlife; replacement and avoidance of damage to vernal pools; surveys for sensitive plant and wildlife species followed by design and implementation of species-specific mitigation plans as required by state and federal agencies; creation or restoration of on-site habitat for raptors, including burrowing owls; monitoring of sensitive fish populations; and preparation of a mosquito abatement plan.	Potentially significant; feasibility and effectiveness of mitigations are unknown.
Leonard/Redwood, Montezuma	Cultural Resources	On Montezuma Wetlands, two historic archaeological sites would be impacted by restoration ground disturbances. Potential for unrecorded resources on Montezuma Wetlands and Leonard Ranch/Redwood Landfill to be encountered during construction.	Design dredged material disposal to avoid all known prehistoric and historic resources, including a 50-foot buffer surrounding archaeological artifact scatters. If cultural resources are identified and unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative C2. All Upland Disposal				
Leonard/Redwood, Montezuma	Noise	At the Montezuma Wetlands site, pumps would cause excessive noise.	Install "critical" grade silencers; partially or completely enclose pumps.	Insignificant.
Leonard/Redwood, Montezuma	Transportation	Trucking dredged material to the Redwood Landfill would increase risk of accidents and congestion.	Avoid peak hours.	Insignificant.
Leonard/Redwood, Montezuma	Land Use	The containment levee at Leonard Ranch would partially obstruct scenic views of the bay plain.	Increase the setback of the containment levee from SR 37 to reduce obstruction.	Impacts reduced but may not be insignificant.
Alternative D1. Maximum Confined Aquatic Disposal				
Bay Farm	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' emissions NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance.
Bay Farm	Hydrology	Dissolved oxygen concentrations measured below 5 mg/L RWQCB standard. Release of contaminant constituents during dredged material disposal.	Avoid disposing materials during seasonal periods when oxygen demand is high. Collect sediments using clamshell dredge to maintain "clumps" of material. Use bottom dump barge for instantaneous release. Minimize the lapse of time between contaminated material placement and cap placement. Do not allow barge to overflow. Do not allow full barges to stand by for more than 24 hours. Use electronic positioning during disposal operations. Use proper logging procedures to verify material placement.	Insignificant. Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative D1. Maximum Confined Aquatic Disposal				
Bay Farm	Hydrology (cont.)	Release of contaminant constituents during dredged material disposal.	Potentially, use taut line buoys to help position at the site. During cap placement, use methods to minimize turbidity.	Insignificant.
Bay Farm	Geology, Soils, and Seismicity	Degradation of site sediments prior to placement of cap.	Adherence to cap design. Minimize exposure time of contaminated sediments. Apply uniform layers of cap material to ensure adequate coverage. Use electronic positioning during disposal operations to ensure accurate placement of materials.	Insignificant.
Alternative E1. Maximum Unconfined Aquatic Disposal				
Ocean, Alcatraz, Galbraith	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' emissions NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment. Excessive fugitive dust generation from exposed soil at Galbraith.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control. When necessary, apply a soil binding agent, such as water, during construction or when large amounts of bare soil are exposed. When necessary, cover trucks with tarpaulins or use an equivalent method.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance. Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative E1. Maximum Unconfined Aquatic Disposal				
Ocean, Alcatraz, Galbraith	Hydrology	At the Galbraith site, significant impacts on groundwater quality due to the lateral migration of existing leachate fluids containing petroleum products.	Design containment structures to meet RWQCB requirements.	Insignificant.
		At the Galbraith site, data show that discharge of surface water may exceed water quality objectives. Additionally, data may not adequately predict potential water quality impacts.	Vegetative control areas will be placed outside of the drying ponds to increase sedimentation and provide natural treatment for metals. Effluent monitoring will show whether RWQCB standards are being met. If standards are not met, decant water can be held in the ponds for an extended period.	Insignificant.
		Placement on the Galbraith site of sediments containing elevated levels of contaminants exceeding levels acceptable to the RWQCB.	The Port will conduct additional sampling after the dredged material dries to confirm that there are no "hot spots" present.	Insignificant.
Ocean, Alcatraz, Galbraith	Geology, Soils, and Seismicity	If a large magnitude earthquake occurred on a nearby fault, earthquake-induced levee failure at the Galbraith site could cause geologic hazards on surrounding features such as Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative E1. Maximum Unconfined Aquatic Disposal				
Ocean, Alcatraz, Galbraith	Biological Resources	At Galbraith, loss of approximately 3.7 acres of seasonal freshwater marsh, tidal wetlands, and other waters of the U.S. (exact acreage to be determined by the Corps).	Avoidance to extent possible; on-site creation of wetland habitat to offset losses at a ratio of 1.1:1 to 1.3:1.	Insignificant.
		At Galbraith, potential impacts on burrowing owls if present, a species of special concern.	If active burrows are identified during a pre-construction survey, owls and burrows will be relocated off site.	Insignificant.
		At Galbraith, seasonal ponding may increase mosquitos.	Consult with Alameda County Mosquito Abatement District.	Insignificant.
		At Galbraith, disturbance of aquatic biota by pipeline construction and pumping operations; potential impacts from fuel spills or a break in slurry pipeline.	Set anchors for the duration of the project; careful handling of fuel; install leak detection system on the pipe and/or monitor slurry discharge.	Insignificant.
Ocean, Alcatraz, Galbraith	Noise	At the Galbraith site, the unloader and booster pumps could cause excessive noise depending on their placement.	Locate or muffle pumps so that noise does not exceed 60 dBA between 7 A.M. and 10 P.M. and 50 dBA between 10 P.M. and 7 A.M.	Insignificant.
Ocean, Alcatraz, Galbraith	Land Use	Loss of golfing recreational uses during the 7-year interim construction phase at the Galbraith Golf Course.	Allow for continuance of youth golfing program. Subsidize senior golf clubs, and Oakland senior use of nearby golf course. A new golf course would be provided at the end of the dredged sediment drying phase.	Significant (during construction only).
		Loss of municipal soccer field on Galbraith Golf Course site.	The City of Oakland will construct a new soccer field at the Curt Flood Sports Complex in East Oakland.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative E2. Maximum Unconfined Aquatic Disposal				
Ocean, Bay Farm, Galbraith	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' emissions NO_x and SO₂ and (2) BACT thresholds for all pollutants from dredging and transport equipment. Excessive fugitive dust generation from exposed soil at Galbraith.	Retard injection timing of diesel-powered equipment for NO_x control and use of reformulated diesel fuel for TOG/ROG and SO₂ control. When necessary, apply a soil binding agent, such as water, during construction or when large amounts of bare soil are exposed. When necessary, cover trucks with tarpaulins or use an equivalent method.	Same as Alternative A1. Insignificant.
Ocean, Bay Farm, Galbraith	Hydrology	At the Galbraith site, significant impacts on groundwater quality due to the lateral migration of existing leachate fluids containing petroleum products. At the Galbraith site, data show that discharge of surface water may exceed water quality objectives. Additionally, data may not adequately predict potential water quality impacts. Placement on the Galbraith site of sediments containing elevated levels of contaminants exceeding levels acceptable to the RWQCB.	Design containment structures to meet RWQCB requirements. Vegetative control areas will be placed outside of the drying ponds to increase sedimentation and provide natural treatment for metals. Effluent monitoring will show whether RWQCB standards are being met. If standards are not being met, decant water can be held in the ponds for an extended period. The Port will conduct additional sampling after the dredged material dries to confirm that there are no "hot spots" present.	Insignificant. Insignificant. Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative E2. Maximum Unconfined Aquatic Disposal				
Ocean, Bay Farm, Galbraith	Geology, Soils, and Seismicity	If a large magnitude earthquake occurred on a nearby fault, earthquake-induced levee failure at the Galbraith site could cause geologic hazards on surrounding features such as Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.
Ocean, Bay Farm, Galbraith	Biological Resources	At Galbraith, loss of approximately 3.7 acres of seasonal freshwater marsh, tidal wetlands, and other waters of the U.S. (exact acreage to be determined by the Corps).	Avoidance to extent possible; on-site creation of wetland habitat to offset losses at a ratio of 1.1:1 to 1.3:1.	Insignificant.
		At Galbraith, potential impacts on burrowing owls if present, a species of special concern.	If active burrows are identified during a pre-construction survey, owls and burrows will be relocated off site.	Insignificant.
		At Galbraith, seasonal ponding may increase mosquitos.	Consult with Alameda County Mosquito Abatement District.	Insignificant.
		At Galbraith, disturbance of aquatic biota by pipeline construction and pumping operations; potential impacts from fuel spills or a break in slurry pipeline.	Set anchors for the duration of the project; careful handling of fuel; install leak detection system on the pipe and/or monitor slurry discharge.	Insignificant.
Ocean, Bay Farm, Galbraith	Noise	At the Galbraith site, the unloader and booster pumps could cause excessive noise depending on their placement.	Locate or muffle pumps so that noise does not exceed 60 dBA between 7 A.M. and 10 P.M. and 50 dBA between 10 P.M. and 7 A.M.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/ Mitigation
Alternative E2. Maximum Unconfined Aquatic Disposal				
Ocean, Bay Farm, Galbraith	Land Use	Loss of golfing recreational uses during the 7-year interim construction phase at the Galbraith Golf Course.	Allow for continuance of youth golfing program. Subsidize senior golf clubs, and Oakland senior use of nearby golf course. A new golf course would be provided at the end of the sediment drying phase.	Significant (during construction only).
		Loss of municipal soccer field on Galbraith Golf Course site.	The City of Oakland will construct a new soccer field at the Curt Flood Sports Complex in East Oakland.	Insignificant.
Alternative E3. Maximum Unconfined Aquatic Disposal				
Ocean, Alcatraz, Leonard/Redwood	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' emissions NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance.
		Excessive fugitive dust generation from exposed soil at Leonard/ Redwood.	Apply water to exposed soil, as needed, to minimize dust emissions.	Insignificant.
Ocean, Alcatraz, Leonard/Redwood	Geology, Soils, and Seismicity	At the Leonard Ranch site, earthquake-induced levee failure at the site could cause geologic hazards on Highway 37 and the adjacent railroad tracks, if a large magnitude earthquake occurred on a nearby fault.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.
Ocean, Alcatraz, Leonard/Redwood	Biological Resources	At the Leonard Ranch site, loss or replacement of up to 31 acres of wetlands.	On-site creation of wetlands to offset losses. Off-site wetland creation or restoration at a 4:1 ratio.	Insignificant.
		At the Leonard Ranch site, disturbance of sensitive bird species (e.g., California clapper rail) nesting in salt marsh along San Pablo Bay.	Conduct preconstruction nesting surveys for sensitive bird species; avoid construction within 500 feet of active nests during the nesting season (Feb 1-Aug 31).	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative E3. Maximum Unconfined Aquatic Disposal				
Ocean, Alcatraz, Leonard/Redwood	Cultural Resources	Potential for encountering unrecorded sources on Leonard Ranch/Redwood Landfill during construction.	Perform intensive survey by qualified archaeologists. If cultural resources are identified and unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.
Ocean, Alcatraz, Leonard/Redwood	Transportation	Trucking dredged material to the Redwood Landfill would increase risk of accidents and congestion.	Avoid peak hours.	Insignificant.
Ocean, Alcatraz, Leonard/Redwood	Land Use	The containment levee at Leonard Ranch would partially obstruct scenic views of the bay plain.	Increase the setback of the containment levee from SR 37 to reduce obstruction.	Impacts reduced but may not be insignificant.
Alternative E4. Maximum Unconfined Aquatic Disposal				
Ocean, Bay Farm, Leonard/Redwood	Air Quality	Exceedance of AQMD thresholds for (1) one percent combined Counties' emissions NO _x and (2) BACT thresholds for all pollutants from dredging and transport equipment. Excessive fugitive dust generation from exposed soil at Leonard/Redwood.	Retard injection timing of diesel-powered equipment for NO _x control and use of reformulated diesel fuel for TOG/ROG and SO ₂ control. Apply water to exposed soil, as needed, to minimize dust emissions.	SO ₂ impacts reduced to insignificance. Remaining impacts reduced, but not to insignificance. Insignificant.
Ocean, Bay Farm, Leonard/Redwood	Geology, Soils, and Seismicity	At the Leonard Ranch site, earthquake-induced levee failure at the site could cause geologic hazards on Highway 37 and the adjacent railroad tracks, if a large magnitude earthquake occurred on a nearby fault.	Design levees using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.	Insignificant.

Table S-2. Summary of Potentially Significant Impacts
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Applicable Disposal Sites	Resource	Potentially Significant Impact	Management/Mitigation Measure	Significance after Management/Mitigation
Alternative E4. Maximum Unconfined Aquatic Disposal				
Ocean, Bay Farm, Leonard/Redwood	Biological Resources	At Leonard Ranch, loss or replacement of up to 31 acres of wetlands.	On-site creation of wetlands to offset losses. Off-site wetland creation or restoration at a 4:1 ratio.	Insignificant.
Ocean, Bay Farm, Leonard/Redwood	Cultural Resources	Potential for encountering unrecorded sources on Leonard Ranch/Redwood Landfill during construction.	Perform intensive survey by qualified archaeologists. If cultural resources are identified and unavoidable, develop a Memorandum of Agreement (MOA) among the State Historic Preservation Officer, the Corps, and applicable County agency. The MOA would identify relevant federal, state, and local guidelines for performing phased data recovery of cultural resources, including significance assessment, mitigation, and evaluation of unexpected resources encountered during construction.	Insignificant.
Ocean, Bay Farm, Leonard/Redwood	Transportation	Trucking dredged material to the Redwood Landfill would increase risk of accidents and congestion.	Avoid peak hours.	Insignificant.
Ocean, Bay Farm, Leonard/Redwood	Land Use	The containment levee at Leonard Ranch would partially obstruct scenic views of the bay plain.	Increase the setback of the containment levee from SR 37 to reduce obstruction.	Impacts reduced but may not insignificant.

Table S-3. Disposal Sites' Compliance with Environmental Requirements
(page 1 of 2)

Environmental Requirement	Ocean Section 102 Site	Alcatraz	Bay Farm Borrow Area	Leonard Ranch/ Redwood Landfill	Sonoma Baylands	Galbraith Golf Course	Port/ Landfill	Montezuma Wetlands
International Treaty								
London Convention	FC	NA	NA	NA	NA	NA	NA	NA
Federal Laws and Regulations								
National Environmental Policy Act	FC	FC	FC	FC	FC	FC	FC	FC
Clean Water Act	NA	FC	FC	FC	FC	FC	FC	FC
Clean Air Act	PC	PC	PC	PC	PC	PC	PC	PC
Coastal Zone Management Act (BCDC Management Plan ¹ or California Coastal Act)	FC	NC	NC	FC	FC	FC	FC	FC
Marine Protection, Research, and Sanctuaries Act	FC	NA	NA	NA	NA	NA	NA	NA
Fish and Wildlife Coordination Act	FC	FC	FC	FC	FC	FC	NA	PC
Endangered Species Act	FC	FC	FC	FC	FC	FC	FC	FC
National Historic Preservation Act	FC	FC	FC	PC	FC	FC	FC	FC
Farmland Protection Policy Act	NA	NA	NA	FC	FC	NA	NA	NA
FAA Requirements	NA	NA	NA	NA	NA	FC	NA	NA
Submerged Lands Act	NA	FC	FC	NA	NA	NA	NA	NA
Federal Water Project Recreation Act	FC	FC	FC	FC	FC	FC	NA	FC
Rivers and Harbors Act	NA	FC	FC	FC	FC	NA	NA	FC
Migratory Bird Treaty Act	FC	FC	FC	FC	NA	FC	NA	FC
Migratory Bird Conservation Act	FC	FC	FC	FC	FC	NA	NA	FC
Executive Order 12898 (Environmental Justice)	NA	NA	NA	NA	NA	FC	NA	NA

Table S-3. Disposal Sites' Compliance with Environmental Requirements
(page 2 of 2)

Environmental Requirement	Ocean Section 102 Site	Alcatraz	Bay Farm Borrow Area	Leonard Ranch/ Redwood Landfill	Sonoma Baylands	Galbraith Golf Course	Port/ Landfill	Montezuma Wetlands
State of California Laws and Regulations								
California Environmental Quality Act	FC	FC	FC	FC	FC	FC	FC	PC
California Wetlands Policy	NA	NA	NA	FC	FC	FC	NA	FC
Porter-Cologne Water Quality Control Act	NA	FC	FC	FC	FC	FC	FC	FC
State Lands Commission policies	NA	NA	NA	FC	FC	FC	FC	FC
California Endangered Species Act	FC	FC	FC	FC	FC	FC	FC	FC
McAteer-Petris Act	NA	FC	FC	NA	FC	FC	NA	FC
Suisun Marsh Preservation Act	NA	FC	FC	NA	FC	FC	NA	FC
Local Laws and Regulations								
Regional Water Quality Control Board Dredging Policy for San Francisco Bay	NA	FC	FC	NA	NA	NA	NA	NA
Local Land Use Requirements	NA	NC	NC	PC	FC	PC	FC	PC

Legend: FC = Full compliance. All requirements of the law, policy, or related regulations would be met.
 PC = Partial compliance. Some requirements of the law, policy, or related regulations may not be met. Refer to the text of section 2.9 for additional information.
 NC = Not in compliance. Use of the site would conflict with the law, policy, or related regulations. Refer to the text of section 2.9 for additional information.
 NA = Not applicable. The law, policy, or related regulations do not apply to the disposal site.

Note: 1. The BCDC regulations and plans, such as the San Francisco Bay Plan and Suisun Marsh Protection Plan, constitute consistency with these plans is also considered under local laws, regulations below the approved coastal management plan for the San Francisco Bay Area under the Coastal Zone Management Act.

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- B: Air Quality Emission Tables
- C: Biological Resources
- D: Groundwater Quality Data
- E: Compliance of the Selected Plan with the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act
 - E1. Section 404(b)(1) Evaluation
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- F: Visual Analysis (bound separately; limited distribution)
- G: Detailed Project Alternatives Analysis
- H: U.S. Fish and Wildlife Service's Draft Coordination Act Report
- I: Department of Transportation Act, Section 4(f) Evaluation, Galbraith Golf Course Site
- J: Mitigation and Monitoring Requirements for the Selected Plan
- K: Sediment Characterization for Wetland and Upland Disposal
- L: Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Use
- M: Comments on the Draft SEIR/S (bound separately with Appendix N)
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ACRONYMS

AADT	annual average daily traffic volumes
ACFCWCD	Alameda County Flood Control and Water Conservation District
ADT	average daily traffic
AIRFA	American Indian Religious Freedom Act
APE	Area of Potential Effects
ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BARCT	Best Available Retrofit Control Technology
BCDC	Bay Conservation and Development Commission
BERH	Board of Engineer for Rivers and Harbors
BFBA	Bay Farm Borrow Area
BMP	Best Management Practices
B.P.	years before present
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CAP	1991 Bay Area Clean Air Plan
CAR	Coordination Act Report
CCAA	California Clean Air Act
CCC	California Coastal Commission
CCMP	Comprehensive Conservation and Management Plan
CDFG	California Department of Fish and Game
CDWR	California Department of Water Resources
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CNDDDB	California Natural Diversity Data Base
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
COE	U.S. Army Corps of Engineers
CV-RWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
cy	cubic yards
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
dB	decibel
dBA	A-weighted decibel
DDE	diphenyldichloroethylene
DIFID	Disposal from Instantaneous Dump
DO	dissolved oxygen
DOHS	California Department of Health Services
EBMUD	East Bay Municipal Utilities District
EHS	Environmental Health Service
EIR	Environmental Impact Report
EIS	Environmental Impact Statement

1	ERC	Environmental Review Committee
2	ER-L	Effects Range-Low
3	ER-M	Effects Range-Medium
4	ESA	Endangered Species Act
5	EPA	Environmental Protection Agency
6	FAA	Federal Aviation Administration
7	FEIS	Final Environmental Impact Statement
8	FEMA	Federal Emergency Management Administration
9	FONSI	Finding of No Significant Impact
10	FWS	U.S. Fish and Wildlife Service
11	gpm	gallons per minute
12	HLA	Harding Lawson Associates
13	HOV	high-occupancy vehicle
14	JPA	Joint Power Authority
15	km	kilometer
16	LDC	London Dumping Convention
17	L_{dn}	day-night equivalent noise level
18	LEA	Land Extensive Agriculture
19	L_{eq}	energy equivalent noise level
20	LOS	level of service
21	LTMS	Long-Term Management Strategy
22	MCL	maximum contaminant level
23	mcy	million cubic yards
24	MLLW	mean lower low water
25	MOA	Memorandum of Agreement
26	MOIA	Metropolitan Oakland International Airport
27	mph	miles per hour
28	msl	mean sea level
29	MTC	Metropolitan Transportation Commission
30	MTS	Metropolitan Transportation System
31	$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
32	mg/L	milligrams per liter
33	mgd	million gallons per day
34	MPRSA	Marine Protection, Research, and Sanctuaries Act
35	NAAQS	National Ambient Air Quality Standards
36	NAS	Naval Air Station
37	NED	National Economic Development
38	NEPA	National Environmental Policy Act
39	ng/L	nanograms per liter
40	NGVD	1929 National Geodetic Vertical Datum (mean sea level in 1929)
41	NHS	National Highway System
42	NMFS	National Marine Fisheries Service
43	NO	nitric oxide
44	NO_2	nitrogen dioxide
45	NO_x	nitrogen oxides
46	NODS	Navy ocean disposal site
47	NOI	Notice of Intent
48	NOP	Notice of Preparation

ACRONYMS

1	NPDES	National Pollutant Discharge Elimination System
2	NSC	Naval Supply Center
3	NSRL	No-Significant-Risk Levels
4	NTU	nephelometric turbidity unit
5	OBM	older bay mud
6	ODMDS	ocean dredged material disposal site
7	OMZ	oxygen minimum zone
8	O ₃	ozone
9	PAH	polycyclic aromatic hydrocarbon
10	PCB	polychlorinated biphenyl
11	PG&E	Pacific Gas & Electric Company
12	PM ₁₀	particulate matter smaller than 10 microns in diameter
13	ppm	parts per million
14	PPD	Pollutant Policy Document
15	ppt	parts per thousand
16	PRBO	Point Reyes Bird Observatory
17	ROG	reactive organic gas
18	ROI	region of influence
19	RWQCB	Regional Water Quality Control Board
20	SCS	Soil Conservation Service
21	SEIR/S	Supplemental Environmental Impact Report/Statement
22	SFBAAB	San Francisco Bay Area Air Basin
23	SFEP	San Francisco Estuary Project
24	SF-RWQCB	San Francisco Regional Water Quality Control Board
25	SHPO	State Historic Preservation Officer
26	SIP	State Implementation Plan
27	SLC	State Lands Commission
28	SNOI	Supplemental NOI
29	SNOP	Supplemental NOP
30	SO ₂	sulfur dioxide
31	SPTC	Southern Pacific Transportation Company
32	SPP	suspended particulate phase
33	STFATE	Short-Term FATE (modeling program)
34	STLC	soluble threshold limit concentration
35	SWRCB	State Water Resources Control Board
36	TBT	tributyltin
37	TCE	trichloroethylene
38	TCLP	toxicity characteristic leaching procedure
39	TDS	total dissolved solids
40	TEU	20-foot equivalent unit
41	TOC	total organic compounds
42	TOG	total organic gases
43	TPH	total petroleum hydrocarbons
44	TSS	total suspended solids
45	TTLC	total threshold limit concentration
46	TVS	total volatile solids
47	UP	Union Pacific Railway
48	USACE	U.S. Army Corps of Engineers

1	USEPA	U.S. Environmental Protection Agency
2	U.S.C.	United States Code
3	V/C	volume to highway capacity ratio
4	VOC	volatile organic compounds
5	VPH	vehicles per hour
6	VTs	Vessel Traffic Service
7	WES	U.S. Army Engineer Waterways Experiment Station
8	WET	waste extraction test
9	WQC	water quality criteria
10	WQOL	water quality objective limits
11	WRDA	Water Resources Development Act
12	YBM	younger bay muds
13		

GLOSSARY

<i>Anchorage area:</i>	An area designated by the U.S. Coast Guard for the anchoring of ships in the harbor.
<i>Berth:</i>	The water area at the waterfront edge of a wharf, reserved for a vessel. The term is sometimes used to refer to the dock or wharf structure.
<i>Bioassay:</i>	The use of living organisms to determine the effect of some substance, factor, or condition.
<i>Breakwater:</i>	An engineering structure to afford shelter from wave action.
<i>Channel:</i>	The buoyed, dredged, and policed fairway through which ships proceed from the sea to their berth or from one berth to another within the harbor.
<i>Community:</i>	As in "plant community" or other type of biological community; a distinctive collection of species occurring together in a particular habitat.
<i>Construction staging areas:</i>	An area where construction equipment, supplies, and construction offices are located.
<i>Decibel:</i>	A unit of sound measurement.
<i>Dredging:</i>	The removal of bottom sediments in order to deepen or widen a waterway.
<i>Filter feeding:</i>	Obtaining food by passing water through a filtering mechanism.
<i>Holocene (Recent):</i>	The post-Pleistocene geological epoch characterized by fluctuating but generally moderate climates, rising sea levels, and modern animal species; dating to approximately 11,000 years before present, to the present.
<i>Inversion:</i>	A condition where a layer of cool air or water is trapped under a layer of warm air or water so that it cannot rise.
<i>Leachate:</i>	A solution obtained by leaching, as in the downward percolation of water through soil or solid waste and containing soluble substances, such as at a landfill.
<i>Lead agency:</i>	The public agency that has the principal responsibility for carrying out or approving a project.
<i>Mean lower low water:</i>	The average height of the lower of the daily low tides.
<i>Nephelometer:</i>	A device for measuring the size and concentration of particles in a liquid by an analysis of the light transmitted through or reflected by the liquid.
<i>Nutrient:</i>	A substance that promotes growth or provides energy for biological processes; common nutrients are phosphate, nitrate, calcium, and potassium.

<i>Obsidian:</i>	Natural volcanic glass. This was the premier material for Native American stone tool manufacture in California, where it was obtained, often by long distance trade, from more than 25 separate sources.
<i>Phytoplankton:</i>	Microscopic, usually one-celled plants that drift in the surface waters of the ocean.
<i>Pier:</i>	The location in a seaport at which cargo arrives or departs. A dock for loading or unloading ships or vessels.
<i>Pleistocene:</i>	A late Cenozoic geologic epoch characterized by fluctuating, generally cool climates -- often accompanied by glaciation -- and distinctive animal species, dating from 3 million years ago until approximately 11,000 years ago.
<i>Pliocene:</i>	The late Cenozoic geologic epoch following the Miocene and preceding the Pleistocene; dating from approximately 5 million until 3 million years ago.
<i>Responsible agency:</i>	A public agency other than the lead agency that has responsibility for carrying out or approving a project.
<i>Sediment:</i>	Particles and fine matter heavy enough to settle to the bottom of a water column.
<i>Spud:</i>	An extendible pile mounted on the side of a dredge or barge which can be driven into bottom sediments under its own weight to anchor the dredge or barge into position.
<i>Suitable material:</i>	Dredged material that is suitable for unconfined aquatic disposal.
<i>Turbidity:</i>	A cloudy, hazy condition in the water due to the presence of suspended particles, reducing the transmission of light.
<i>Unconsolidated sediments:</i>	Those sediments that have not been compressed into a firm consistency; mud.
<i>Unsuitable material:</i>	Dredged material that is unsuitable for unconfined aquatic disposal.
<i>Upland:</i>	In this document, referring to terrestrial (on land) areas.
<i>Wetlands:</i>	Lands that are periodically or permanently inundated by surface or groundwater and support vegetation adapted for life in saturated soil. Wetlands include marshes, swamps, bogs, and similar areas.

List of Measurements

cm	centimeters
cm/sec	centimeters per second
cy	cubic yards
°C	degrees Celsius
°F	degrees Fahrenheit
ft	feet
km ²	square kilometers
m	meters
m ²	square meters
mcy	million cubic yards
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ng/L	nanograms per liter
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
μg - Atoms/L	micrograms- atoms per liter
μg/L	micrograms per liter
μM/L	micromoles per liter

Unit Conversions

<i>Multiply</i>	<i>By</i>	<i>To Obtain</i>
milligrams per liter	1	parts per million (fluid)
milligrams per kilogram	1	parts per million (soils, sediments)
micrograms per liter	1	parts per billion (fluid)
nanograms per liter	1	parts per trillion (fluid)
feet	0.3048	meters
miles (nautical)	1.853	kilometers
miles (statute)	1.609	kilometers
inches	2.540	centimeters
cubic yards	0.7646	cubic meters
miles per hour	44.70	centimeters per second
square feet	0.09290	square meters
square miles (nautical)	3.434	square kilometers
μM/L	molecular weight	micrograms per liter
μg - Atoms/L	1/atomic weight	micrograms per liter

Multiples and Submultiples

<i>Prefix</i>	<i>Symbol</i>	<i>Equivalent</i>	<i>Factor</i>
nano-	n	billionth part	$\times 10^{-9}$
micro-	μ	millionth part	$\times 10^{-6}$
milli-	m	thousandth part	$\times 10^{-3}$
centi-	c	hundredth part	$\times 10^{-2}$
kilo-	k	thousandfold	$\times 10^3$

ERRATA

Final SEIR/S Oakland Harbor Deep-Draft Navigation Improvements

Appendix E1: Section 404(b)(1) Evaluation for the Proposed Navigation Improvements in Oakland Harbor, California

Page E1-8, 1st full paragraph, 10th line: "tidal lands" should read "tidal wetlands".

Page E1-10, section 2.5.5.2, 2nd paragraph, 5th line: "tidal lands" should read "tidal wetlands".

Page E1-15, section 3.2.4, 1st paragraph, 5th line: "1,600 acres" should read "576 acres".

Page E1-17, section 3.2.6, 1st paragraph, 5th line: "1,600 acres" should read "576 acres".

Page E1-18, section 3.2.7, 1st paragraph, 5th line: "1,600 acres" should read "576 acres".

1.0 NEED FOR AND OBJECTIVES OF ACTION

1.1 PROJECT AUTHORITY

The U.S. Army Corps of Engineers (the Corps) conducted the feasibility study of the Oakland Outer Harbor Channel in response to a resolution adopted June 14, 1972, by the Committee of Public Works of the U.S. House of Representatives. The resolution requested review of prior reports and recommendations for developing the channel to serve deep-draft shipping needs. The Oakland Inner Harbor study resulted from a House of Representatives resolution of May 10, 1977, to develop recommendations for improving the Inner Harbor including consideration of increasing the channel depth (COE 1988).

The initial study for Oakland Outer Harbor, including a Final Environmental Impact Statement (FEIS), was transmitted to Congress on February 1, 1985. Environmental impacts of the Outer Harbor project were assessed in the *Final Environmental Statement, Oakland Outer Harbor Deep-Draft Navigation Improvements, Alameda County, California*, which was filed with EPA on February 20, 1981. The feasibility study for Oakland Inner Harbor and FEIS was transmitted to Congress on January 26, 1985. The environmental impacts of the Inner Harbor project were assessed in the *Final Feasibility Study and Environmental Impact Statement, Oakland Inner Harbor Deep-Draft Navigation Improvements* which was filed with the EPA on April 18, 1985. Both projects were authorized for construction by the Water Resources Development Act of 1986 (Public Law 99-662) (COE 1988).

1.2 PLANNING OBJECTIVES/CONSTRAINTS

Oakland Harbor is located on the east side of San Francisco Bay in Alameda County, California (Figure 1.2-1). Along the Port of Oakland's 19 miles of waterfront are 535 acres of marine terminal facilities, which handle a broad spectrum of import and export cargo. The Port of Oakland consists of an Outer Harbor, a Middle Harbor, and an Inner Harbor. The entrance channel to all three is known as the Bar Channel. The federal channels maintained by the Corps provide access to berthing areas that serve container, general cargo, and roll-on/roll-off vessels. The Oakland Harbor channels were determined to be no longer adequate to efficiently and cost-effectively accommodate modern deep-draft vessels.

The Corps's planning objective for the authorized project is to provide deep-draft navigation improvements in the Oakland Harbor, which would contribute to national economic development (NED). The Corps's planning process requires that the objective be consistent with protecting the environment, pursuant to environmental statutes, relevant executive orders, and other Federal planning requirements. The specific planning objectives for the Oakland Harbor deepening are to reduce tidal delays associated with containership passages, to increase economies of scale for waterborne commerce, and to increase navigation safety. The authorized project deepening would improve navigational safety and efficiency of vessel movement in the harbors. The authorized project would reduce the potential for vessel collisions and groundings, and would lessen the need for tidal dependence by deepening and widening the channel (COE 1988).

The Port of Oakland's planning objective for the project is to accommodate the larger ships that operate in international trade. Since 1985, the number of vessels calling at Oakland with drafts greater than 35

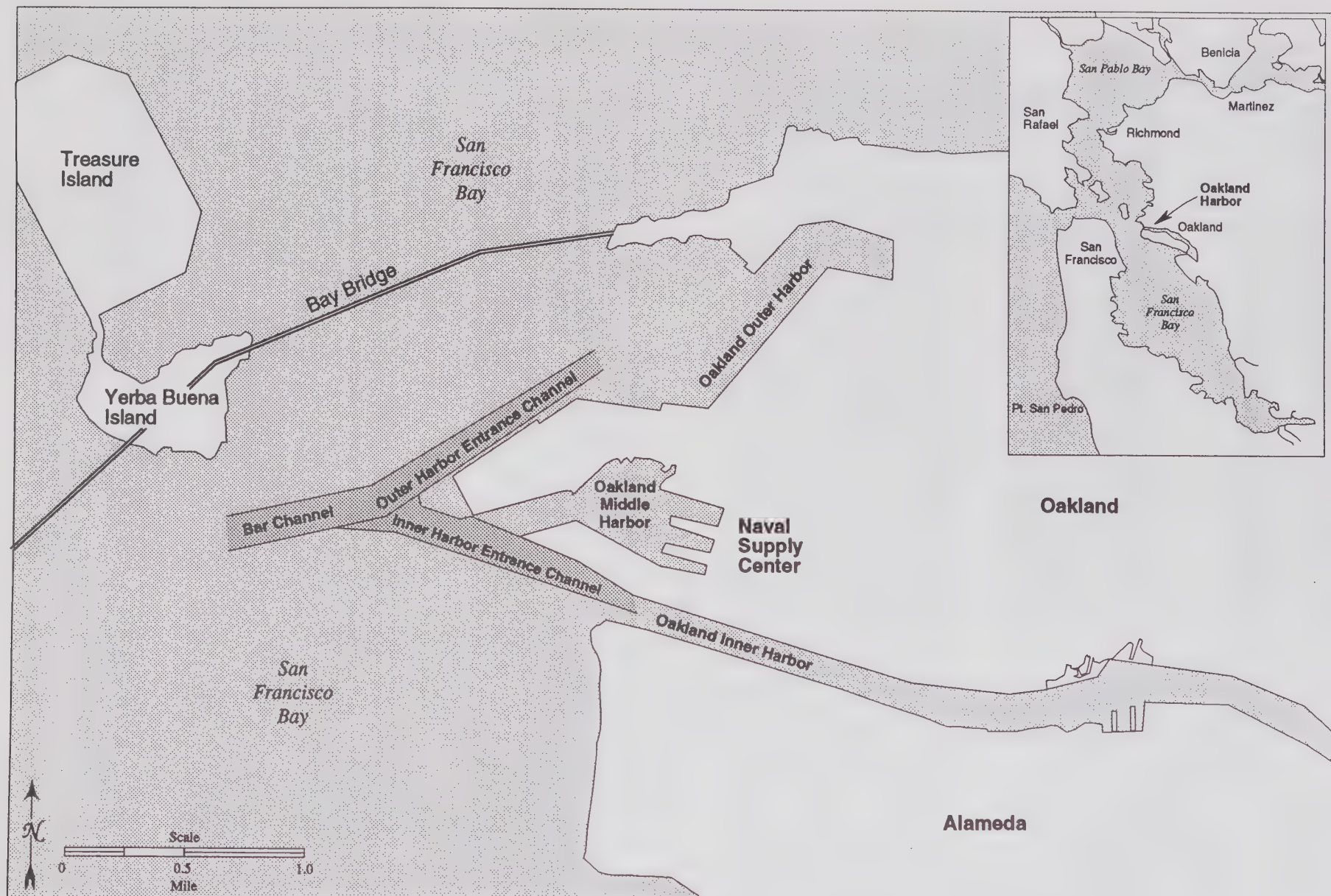


Figure 1.2-1
OAKLAND HARBOR AREA

feet has increased from 29 percent to nearly 74 percent, while vessel calls with drafts in excess of 41 feet have increased almost five times. Lack of deeper channels prevents the major carriers from coordinating the most efficient deployment to coincide with inland rail connections. Vessel delays of 3 hours (due to tides) with the existing channels should be eliminated with the proposed deeper channels. Implementation of the proposed project will enable the Port of Oakland to more efficiently accommodate larger vessels, thus maintaining and potentially increasing the volume of cargo shipped through the Port. Economies of scale plus the increase in the number of shipping lines sharing vessels under space chartering agreements will enable this trend to be continued. The increased volume will provide greater opportunity for employment and will benefit the regional economy.

1.3 PURPOSE OF THE SEIR/S

The environmental effects of authorized channel improvement plans were thoroughly assessed in previous Final Environmental Impact Statements (FEISs). Changing conditions in the form of mounding at the authorized Alcatraz disposal site have required consideration of an ocean disposal site, other in-Bay aquatic disposal sites, and upland sites. This Supplemental Environmental Impact Report/Statement (SEIR/S) has been prepared because use of the Alcatraz site, as authorized for this project, would substantially reduce its capacity and jeopardize its availability for maintenance dredging and other small dredging projects within the Bay. This document thus evaluates additional options for dredged material disposal.

This SEIR/S analyzes the environmental impacts of deep-draft navigation improvements to Oakland Harbor and the disposal of the dredged material at several sites. The authorized improvements would deepen channels to -42 feet mean lower low water (MLLW), plus a required 1 foot of overdepth in those channel and berth areas that contain "hard" material (i.e., Merritt sand and/or Old Bay mud), plus a maximum of 1 foot of allowable overdepth due to the inaccuracies of the dredging process, from -35 feet MLLW in the Outer Harbor and from -38 feet MLLW in most of the Inner Harbor. An existing turning basin in the Outer Harbor would be widened and a new turning basin would be created in the Inner Harbor. Approximately 3.4 miles of the Outer Harbor would be deepened and enlarged. Approximately 4.0 miles of the Inner Harbor channel would be deepened between the Entrance Channel reach and the Howard Terminal. All of these improvements would require the removal and disposal of approximately 6.6 million cubic yards (mcy) of channel bottom sediments.

Dredged material disposal alternatives that are considered in the SEIR/S include aquatic and land disposal. Dredged material disposal in the San Francisco Bay Area is the subject of intensive study by the Corps of Engineers, the EPA, the California Regional Water Quality Control Board, and the San Francisco Bay Conservation and Development Commission under the Long-Term Management Strategy (LTMS). The disposal alternatives discussed in the SEIR/S reflect the LTMS work and address specific sites for the Oakland project. (See section 1.5 for additional detail on the LTMS program.) The SEIR/S considers a number of options for disposal of the dredged material. These disposal options could be implemented separately or in combination, depending on the nature of the sediments that each disposal site can accept and the capacity of the disposal site. The selection of alternative disposal sites will be based on environmental and economic factors. The following eight dredged material disposal site options are considered in detail in the SEIR/S.

Need for and Objectives of Action

Aquatic Sites

- Ocean Section 102 site: Unconfined aquatic disposal at an ocean site offshore the Farallones Islands in the Pacific Ocean, scheduled to be designated in June 1994 by the EPA for that purpose under section 102 of the Marine Protection, Research, and Sanctuaries Act. (Unconfined aquatic disposal means the sediment is deposited and not capped in any way.)
- Alcatraz: Unconfined aquatic disposal at the designated disposal site offshore Alcatraz Island, in central San Francisco Bay.
- Bay Farm Borrow Area: The Bay Farm Borrow area considers both confined and unconfined aquatic disposal of dredged material in San Francisco Bay, offshore the City of Alameda in Alameda County, in south San Francisco Bay. (Confined aquatic disposal means the sediment would be deposited, then capped with cleaner sediments.)

Upland Sites

- Leonard Ranch/Redwood Landfill: Initial disposal and drying of dredged material on the Leonard Ranch property near San Pablo Bay in Sonoma County, followed by ultimate disposal at Redwood Sanitary Landfill in Marin County, where the dried sediments would be used for cover or capping material.
- Sonoma Baylands: Wetland restoration at the proposed Sonoma Baylands, near San Pablo Bay and the mouth of the Petaluma River in Sonoma County.
- Galbraith Golf Course: Fill for disposal and additional cover for a former landfill on Port of Oakland property currently occupied by the Lew F. Galbraith Golf Course in Alameda County.
- Port/Landfill: Initial disposal and drying of dredged material at the Ninth Avenue Marine Terminal in Oakland Harbor, followed by ultimate disposal at one of three landfills if required by the RWQCB.
- Montezuma Wetlands: Fill for disposal and wetland restoration in Suisun Marsh near Collinsville in Solano County.

The SEIR/S will be used by the Corps of Engineers to satisfy requirements of the National Environmental Policy Act (NEPA), and as the primary information document to secure concurrence in a federal Coastal Zone Management Act Consistency Determination. The document will be used by the Port of Oakland to meet its responsibilities under the California Environmental Quality Act (CEQA), and may also be used by the San Francisco Bay Regional Water Quality Control Board, the Bay Conservation and Development Commission, the California Coastal Commission, the State Lands Commission, and any County or City agency issuing a permit. Other reviews in which the SEIR/S may be a secondary source of information include: Fish and Wildlife Coordination Act; Marine Protection, Research, and Sanctuaries Act; Endangered Species Act; Clean Air Act; Clean Water Act; and "trustee agency" reviews by the State of California.

1.4 BACKGROUND AND HISTORY OF THE PROPOSED ACTION

Oakland Harbor has been developed over many years. Following establishment of the town of Oakland in 1852, the first dredging project was undertaken in 1856 at the mouth of San Antonio Creek. In 1859, the second dredging project involved the removal of the sandbar at the mouth of Oakland's Inner Harbor, opening the waterfront to commerce. The City of Oakland authorized the first bond issue for harbor improvements in 1868, and the first transcontinental railroad entered the Oakland waterfront the following year. The disposal location for these dredged materials has been the designated disposal site off Alcatraz Island in central San Francisco Bay.

As originally authorized, disposal of the dredged material from the proposed project was to be at the Alcatraz Island aquatic disposal site, identified by the EPA as SF-11. Since 1982, when mounding of disposed dredged material at the Alcatraz site became apparent, and due to increased public concern about the impact of large-scale dredged material disposal events on the resources of San Francisco Bay, ocean disposal of Oakland Harbor dredged material was proposed in 1988. A Supplemental EIS (SEIS) was prepared to evaluate the impacts of direct ocean disposal and to designate for use an ocean disposal site under section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972. Use of the ocean disposal site was given limited approval by EPA. The Record of Decision following the Final SEIS limited construction to only the "initial phase" (i.e., deepening the Inner Harbor channel from -35 feet MLLW to -38 feet MLLW) of the project with disposal of an estimated 500,000 cubic yards (cy) of material at an ocean site, and directed additional environmental documentation be prepared before construction of the remainder of the authorized project. The Record of Decision allowed limited construction because of the immediate need for the Port of Oakland to accommodate larger deep-draft vessels.

After the Record of Decision was signed, the project was challenged in Federal Court by local fishermen, and construction of the reduced project was delayed. The Federal Court decided not to enjoin the project, and the local sponsor, by Section 215 Agreement (42 USCA sec. 1962D-5A) with the Corps, started construction in May 1988. A few days after this construction began, the project was enjoined in State Court by a suit brought by San Mateo County, and construction was stopped.

The Port decided to investigate the use of dredged sediments to reinforce levees in the Sacramento-San Joaquin Delta. Such a solution could allow disposal to occur more quickly than with ocean disposal, and would have the added advantage of providing a beneficial use of the material. In July 1989, the Port released a Final Supplemental EIR (FSEIR) that evaluated the environmental effects of placing dredged material from the first phase of the Inner Harbor deepening project on the inboard slopes of levees at Twitchell Island and Lower Jones Tract, both located in the Sacramento-San Joaquin Delta area, for levee reinforcement.

Following certification of the FSEIR, substantial problems arose when the Port attempted to obtain the necessary permits for utilization of the two levee sites. The Central Valley Regional Water Quality Control Board (CV-RWQCB) classified the Phase I dredged sediments as a "designated waste," contrary to the Port's position that the sediments were inert waste, due to ambient water quality (i.e., fresh water) at the proposed disposal sites. As a designated waste, the disposal of sediments for levee reinforcement was regulated pursuant to specific provisions under the California Code of Regulations, Title 23, Chapter 3, Subchapter 15. The CV-RWQCB issued a conditional permit for disposal with complex monitoring and related requirements. The Port's consultant, Harding Lawson Associates, estimated that the cost of

Need for and Objectives of Action

monitoring for the first year after completion of dredging and disposal would be \$2.9 million for both delta disposal sites. The annual cost of monitoring for subsequent years was estimated at \$1.0 million, and the CV-RWQCB retained the discretion to determine the duration of the monitoring program.

The affected counties also sought to regulate the disposal as a waste discharge activity and to require special land use permits with uncertain and potentially onerous requirements. Sacramento County indicated that their review process could be quite time consuming. In addition, the State Water Resources Control Board Resolution 68-18 established a non-degradation policy for maintaining water quality in California. Strict interpretation of this resolution could have precluded introduction of the Phase I sediments into the Sacramento-San Joaquin Delta due to potential salinity impacts to water quality.

The Port thus elected not to pursue these delta disposal options due to the costs and time that would have been associated with complying with the permit conditions of the CV-RWQCB and the escalating testing and monitoring requirements of Sacramento and San Joaquin counties.

In 1992, an Environmental Assessment (April 1992) and Finding of No Significant Impact (May 1992) were prepared to deepen a portion of the Oakland Inner Harbor channel from -35 feet MLLW to -38 feet MLLW. Deepening of this portion of the Oakland Inner Harbor channel began in September 1992 with 497,395 cy of dredged sediment disposed at the Alcatraz aquatic site and 19,672 cy disposed initially at the Port Sonoma-Marin upland drying pond site in Sonoma County. After drying, the material at the Port Sonoma-Marin site was to be transported by truck to its final destination at the Redwood Landfill site, located north of the City of Novato in Marin County. Deepening of this portion of the Oakland Inner Harbor channel was completed in December 1992.

During the 5-year period from 1986-1991, roughly 2.7 mcy of material were dredged, primarily for maintenance projects. Of this total, approximately 150,000 cy per year were dredged to maintain the berths in Oakland Harbor. The disposal location for that dredged material was the Alcatraz site.

1.5 PRIOR STUDIES, REPORTS, AND EXISTING PROJECTS

Previous Environmental Analyses of Oakland Harbor Dredging Projects

The environmental impacts of the Oakland Harbor Deepening Project have been analyzed in the following environmental documents listed in chronological order. These documents are incorporated into this SEIR/S by reference.

1. *Final Environmental Statement, Oakland Outer Harbor California, Deep-Draft Navigation Improvements* (COE 1979). The Feasibility Report was prepared under direction of the House Resolution dated June 14, 1973. The study was undertaken as an interim report under the San Francisco Bay In-Depth Study. The Feasibility Report determined that it was in the best interest of the Federal Government to provide a wider channel and turning basin area in the Outer Harbor deepened to -12.8 meters (-42 feet) MLLW.
2. *Oakland Inner Harbor California, Deep-Draft Navigation Final Feasibility Study and Environmental Impact Statement* (COE 1984). The Final Feasibility Study for Oakland Inner Harbor was prepared under the direction of a Congressional Resolution dated May

- 10, 1977. The draft Feasibility Report recommended an optimum depth for the Inner Harbor of 13.1 meters (43 feet) below MLLW. Revisions of the benefits by the Board of Engineer for Rivers and Harbors (BERH) indicated an optimum depth of 12.8 meters (42 feet) and inclusion of the turning basin.
3. *Oakland Harbor Deep-Draft Navigation Improvements, Design Memorandum No. 1 (General Design) and Final Supplement to the Environmental Impact Statement, Alameda County, California* (COE 1988). This project involved deepening the Outer and Inner Harbor channels from an authorized -35 feet MLLW to -42 feet MLLW. Approximately 3.4 miles of the Outer Harbor were to be deepened and the turning basin was to be relocated, deepened, and enlarged. Approximately 4 miles of the Inner Harbor channel was to be deepened between the Entrance Channel reach and the Clay Street Pier. The channel was to be widened at the Inner Harbor entrance, and at the upper end of the project. A turning basin in the Inner Harbor was also to be provided. The total dredged volume, estimated to be 7.0 mcy, was proposed to be disposed at the Alcatraz site, although the SEIS considered disposal at other types of sites: upland sites, including marsh restoration; other in-Bay disposal sites; historic ocean disposal sites; and candidate (new) ocean disposal sites. The following alternative disposal sites were considered in detail in the SEIS: Alcatraz disposal with pre-dredging to candidate ocean site 1M; direct ocean disposal to candidate site 1M; and direct ocean disposal to candidate ocean site B1. While the material was to be disposed at an ocean site named B1B, only a few barge loads were dispersed there from the project.
4. *Oakland Inner and Outer Harbors Deep Draft Navigation Improvement Project, Alameda County, Final Summary Environmental Impact Report* (Port 1988). This EIR incorporated information previously presented in COE-prepared FEISs and SEIS; it also contained an executive summary of anticipated environmental effects identified in these COE documents so that appropriate documentation for CEQA compliance was assured (COE/Port 1991).
5. *Phase I: Oakland Inner Harbor Deep-Draft Navigation Improvements Project. Alameda, Sacramento, San Joaquin Counties. Final Supplemental Environmental Impact Report* (Port 1989). This SEIR evaluated the environmental effects of placing dredged material from the Phase I Oakland Harbor deepening project on the inboard slopes of Twitchell Island and Lower Jones Tract levees, in the Sacramento-San Joaquin Delta area. Developing a plan for delta disposal and levee reinforcement was considered more expedient than completing supplemental studies required to evaluate the effects of B1B ocean disposal site use on fisheries resources and related fishing economies, and would provide a beneficial use of the disposed material.
6. *Appendix D – Finding of No Significant Impact and Environmental Assessment, Oakland Inner Harbor 38-Foot Separable Element, Design Memorandum* (COE 1992a) and Initial Study (Port 1992). This project involved deepening approximately 4 miles of the Oakland Inner Harbor Channel from -35 feet MLLW to -38 feet MLLW. Deepening of this portion of the Oakland Inner Harbor channel began in September 1992 with 565,000 cy of dredged sediment disposed at the Alcatraz aquatic site and an estimated 23,000 cy disposed initially at the Port Sonoma-Marin upland drying pond site in Sonoma County.

Need for and Objectives of Action

After drying, this material will be eventually transported by truck to its final destination at the Redwood Landfill site, located north of the City of Novato in Marin County. Deepening of this portion of the Oakland Inner Harbor channel was completed in December 1992.

Long-Term Management Strategy

The proposed dredging project is also related to the existing LTMS program, which is designed to provide a regional plan for the disposal of up to 400 mcy of dredged material from the San Francisco Bay over the next 50 years. The LTMS program began in January 1990 as a Federal/State partnership between the four agencies that have regulatory authority for dredged material in the San Francisco Bay area: The Corps, the EPA Region IX, the San Francisco Bay Regional Water Quality Control Board (SF-RWQCB), and the San Francisco Bay Conservation and Development Commission (BCDC). These four lead agencies share responsibility for managing the various components of the LTMS.

There are several committees within the LTMS structure. The Executive Committee is composed of the Corps South Pacific Division Engineer, the EPA Regional Administrator, the RWQCB Chairperson, the BCDC Chairperson, and a state coordinator. This committee provides management and policy guidance, and retains principal decision-making authority for LTMS program issues. However, overall LTMS coordination and technical direction is delegated to the Management Committee, which oversees the LTMS work groups and the Technical Review Panel. The Management Committee consists of the Corps South Pacific Division LTMS Program Manager, the EPA Water Management Division Director, the RWQCB Executive Officer, and the BCDC Executive Director.

There are four LTMS work groups: the Ocean Studies Work Group, the In-Bay Work Group, the Nonaquatic/Reuse Work Group, and the Implementation Work Group. Each of these work groups has its own structure, public involvement strategy, and specific objectives. The Ocean, In-Bay, and Nonaquatic/Reuse Work Groups are responsible for conducting the tasks described in the LTMS Study Plan (COE 1991). The Implementation Work Group is the newest of the work groups. The Steering Committee of this work group has recently proposed a series of subcommittees to deal with the issues of siting framework, sediment quality, financing and ownership, containment sites, a programmatic management document, and project coordination.

The Technical Review Panel is composed of five scientific experts who provide critical reviews of technical issues that lie outside of the LTMS program's broad conceptual approach.

The LTMS structure also includes an advisory group, the Policy Review Committee, which is comprised of a broad range of Federal and State agencies, ports, development, environmental, and fishing interests. This committee meets quarterly and provides an important forum for public involvement in, and review of, LTMS development and implementation. Another mechanism for public involvement in the LTMS is the San Francisco Estuary Project, which serves to disseminate information to the general public through its outreach programs.

Other Existing Projects

Other related projects and plans are described in Chapter 10 (Cumulative Impacts).

1 **1.6 PUBLIC CONCERNS**

2
3 Public comment on the proposed project was solicited pursuant to federal and state requirements. This
4 process is described in Chapter 13 of the SEIR/S. Public comments were solicited so that those issues
5 of concern to the public and all reasonable alternatives could be considered in the environmental analysis.
6 Public concerns raised during this process are summarized in Chapter 13 of the SEIR/S.
7

8 **1.7 RESPONSIBLE OR TRUSTEE AGENCIES**

9
10 The responsible or trustee agencies listed below will rely, in part, on this SEIR/S for decisions they may
11 make associated with the proposed project. The permits or approvals these agencies may grant associated
12 with the project are summarized in section 2.9.5.
13

- 14 • U.S. Army Corps of Engineers
- 15 • Environmental Protection Agency
- 16 • Federal Aviation Administration
- 17 • California Coastal Commission
- 18 • State Lands Commission
- 19 • San Francisco Bay Conservation and Development Commission
- 20 • Regional Water Quality Control Board
- 21 • Bay Area Air Quality Management District
- 22 • Alameda County Airport Land Use Commission
- 23 • City of Oakland

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

Construction of the proposed navigation improvements to Oakland Harbor, Alameda County, California, was authorized by the Water Resources Development Act of 1986. The Port of Oakland is the non-federal (i.e., local) sponsor of the federal project. The proposed channel and berth improvements would involve the dredging and disposal of approximately 6.6 million cubic yards (mcy) of channel bottom sediments, including overdepth. ("Overdepth" refers to the fact that, in dredging to attain a minimum depth, in this case -42 feet, some additional sediment will be picked up due to inaccuracies in the dredging operation.) In this case, a volume equivalent to 1 foot of overdepth is assumed. The proposed dredging and disposal is anticipated to begin in December 1994 and last for 24 to 27 months.

Disposal of the sediment has been controversial in the Bay Area. As originally authorized, disposal of Oakland Harbor sediment was to be at the historical and currently used aquatic site identified by EPA as SF-11, located near Alcatraz Island in central San Francisco Bay. Other disposal sites are currently being considered for the proposed project because of (1) the mounding of dredged material disposed at Alcatraz; (2) public concern about the impact of large-scale disposal on the resources of the Bay; and (3) recently implemented restrictions on the monthly volume of dredged material that may be disposed of at Alcatraz.

2.2 OAKLAND HARBOR

2.2.1 Proposed Improvements

The proposed improvements are shown in Figure 2.2-1 and include the following:

- Channel deepening to -42 feet mean lower low water (MLLW) from -35 feet MLLW for the Outer Harbor and from -38 feet MLLW for most of the Inner Harbor.
- Deepening and enlarging:
 - 3.4 miles of the Outer Harbor; and
 - 4.0 miles of the Inner Harbor between the Entrance channel reach and the Charles P. Howard Terminal.
- Widening of:
 - The Entrance channel and upper reach of the Inner Harbor; and
 - An existing turning area in the Outer Harbor.
- Construction of a new turning basin in the Inner Harbor west of Howard Terminal.
- Deepening of vessel berthing areas in the Inner and Outer Harbors (by the Port) that are not currently maintained at -42 feet MLLW.

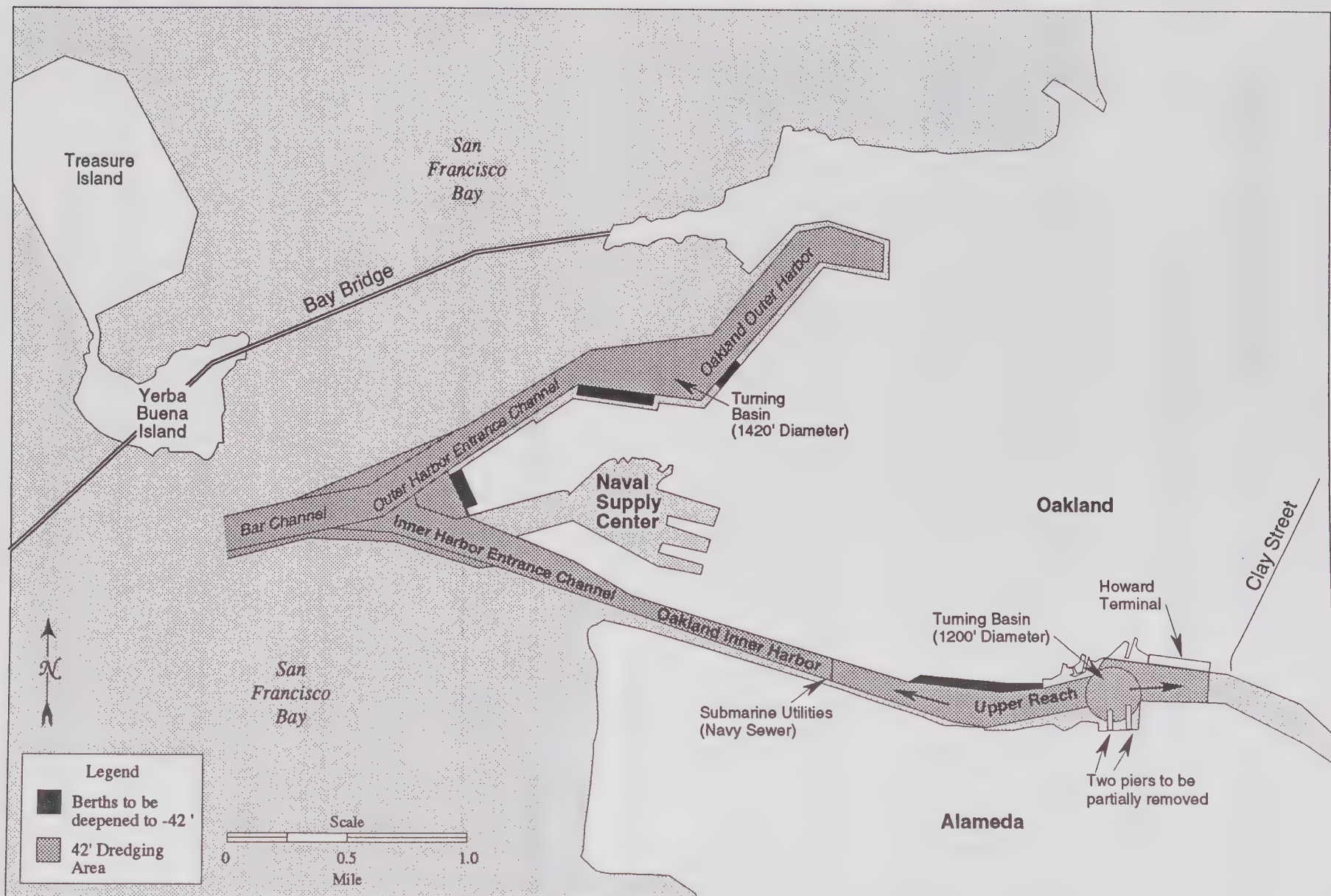


Figure 2.2-1

PROPOSED DREDGE AREA OF OAKLAND HARBOR

- Relocation of existing submarine utilities, i.e., the Navy sewer line.
- Removal of existing pier structures in the project vicinity.

Both clamshell and hydraulic cutterhead dredges could be used. Either type of dredge can be used on material suitable for unconfined aquatic disposal. Ultimately, the choice of dredge will depend on cost-effectiveness. The dredging rate is estimated to be approximately 300 cubic yards (cy) per hour for clamshell dredges and 200 cy per hour for hydraulic dredges, although the exact dredging rate will vary with the disposal alternative selected. Bottom-dump scows (i.e., barges that have an opening in their hull to dump the sediment) ranging in capacity from 800 cy to 4,000 cy could be used to transport the sediments from the dredge site. Use of a bottom dump scow does not necessarily mean the material would be bottom dumped; in some cases, the material would be pumped from the scows onto a land disposal site. For clamshell filled barges of sediments suitable for aquatic disposal, the 3,000-cy scows could hold approximately 2,000-2,500 cy of actual sediment; the rest of the scow's capacity would be taken up by the water that is picked up in the dredge. Hydraulically filled barges would likely be hauling much less solid material because of the relatively greater volume of water brought up by hydraulic dredges. Barge overflow could be necessary with hydraulic dredging to achieve a cost-effective load (i.e., so that the proportion of sediment is maximized). Overflow would only be allowed at the dredge site (not en route to the disposal site), only for sediments deemed suitable for ocean disposal, and would not exceed a period of 15 minutes. The overflow could occur either above the water surface or below the water surface; overflow below the water surface would require barge retrofit. No intentional overflow or spillage would be allowed at any time during transit to the disposal site.

Dredging could occur 24 hours per day, 7 days per week. The number of scow trips necessary to transport the sediment to the disposal sites would depend on the disposal alternative selected.

2.2.2 Associated Maintenance Dredging Requirements

Currently, material from routine maintenance dredging (referred to as operation and maintenance or "O&M" dredging) of Oakland Harbor channels is disposed at Alcatraz, and has averaged approximately 370,000 cy per year from 1975 through 1991.

There would be increased maintenance dredging requirements associated with the proposed deepening of Oakland Harbor. Estimated annual maintenance dredging requirements for the -42 foot Inner Harbor channel would be increased by 60,000 cy for an estimated total annual maintenance dredging volume of 215,000 cy. Estimated annual maintenance dredging requirements for the -42 foot Outer Harbor channel would be increased by 80,000 cy for an estimated total annual maintenance dredging volume of 295,000 cy. The *incremental* increase in maintenance dredging due to the project would thus be 140,000 cy (60,000 cy + 80,000 cy). On an annual basis, this incremental increase due to the project (140,000 cy) represents a 38 percent increase over the historical maintenance dredging volume (370,000 cy). While the project would result in a substantial increase in the *volume* of O&M dredging, the associated environmental *impact* would be insignificant because the project would be maintained under the LTMS policies, and the increased volume would be within the "volume targets" (4 mcy per year) established for Alcatraz. However, use of the Alcatraz site for maintenance dredging in the harbor could change depending upon increasingly stringent sediment quality analysis. In any case, maintenance dredging and disposal associated with the project would be consistent with the LTMS program. Maintenance "episodes" have separate authorizations from dredging projects that involve deepening, and each

Proposed Action and Alternatives

maintenance episode would be evaluated with respect to the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), and the Clean Water Act (CWA). Future maintenance dredging could also be regulated under the Marine Protection, Research, and Sanctuaries Act to the extent that the LTMS Management Plan directs disposal of such material to the Ocean Section 102 site instead of in-Bay sites.

2.3 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the proposed dredging of Oakland Harbor channels to -42 feet MLLW would not occur, and the larger ships would be unable to enter or depart the Port fully laden at low tide. Currently, there are approximately 1,450 deep-draft vessel calls at the Port per year. As of mid-1993, approximately 67 percent of these calls were by vessels with drafts over 35 feet. The trend toward deeper-draft vessels is expected to continue, and by 1996, the Port expects that over 80 percent of the deep-draft vessels calling will require channels exceeding 35 feet.

The Port of Oakland estimates that with the implementation of the proposed project, vessel calls will increase by one to two per week. The analysis of the No-Action Alternative performed by the Port indicates that continuation of transportation inefficiencies would result in no increase in the number of vessel calls. As indicated in Table 4.7.3-1, with the No-Action Alternative, the total volume of cargo handled through the Port is expected to remain relatively flat. The volume and percentage of discretionary cargo (cargo that is subject to the shipper's discretion regarding point of origin or destination) is expected to decline, however, as intermodal cargo would be diverted to other West Coast ports. This would have adverse economic repercussions to the area, since the Port could be reduced in size to a level that would support only the local population.

The economic analysis performed by the Corps for the No-Action Alternative indicates, however, that the same volume of cargo would continue to be shipped through the Port as under the proposed project. The Corps analysis concludes that the most likely case under the No-Action Alternative is that the shippers' overall costs resulting from re-routing of cargo would be greater than the transportation efficiency costs of maintaining Oakland traffic. While the Corps does not consider the Port's projection as the most likely, it is, however, a real possibility.

The No-Action Alternative does not necessarily mean no change from current conditions for the potential dredged material disposal sites, as described below for each of the eight disposal sites that were not eliminated during the site screening process described in section 2.6. As noted below, it is likely that some of the disposal sites (e.g., Sonoma Baylands and Montezuma Wetlands) would still eventually be used for dredged material even if the proposed Oakland Harbor deepening project did not go forward.

- Ocean Section 102 site. Since this site is in the process of being designated by EPA as an ocean disposal site under Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA), it is likely that it would be used for some dredging projects even without the Oakland Harbor deepening project.
- Alcatraz. This site, which has been used historically for dredged material disposal, would likely continue to be used, subject to the target restrictions and the existing management program for this site.

- Bay Farm Borrow Area. Without the Oakland Harbor project, the future use of this site is unknown, although it could be considered as a disposal site at some future point under the LTMS or some other study authority.
- Leonard Ranch/Redwood Landfill. The Leonard Ranch site is identified in the LTMS as one that would be highly feasible for development as a rehandling facility (i.e., a dewatering facility). Congress has authorized the Corps to do the "reconnaissance" level feasibility study on this site, and has approved the money for this level of study. The Redwood Landfill, a permitted facility, would likely continue to serve as a Class III sanitary landfill.
- Sonoma Baylands. Congress has authorized a wetland demonstration project using dredged material at this site. Under the No-Action Alternative, wetland restoration at this site could occur with or without sediments from other dredging project(s).
- Galbraith Golf Course. Without the project, this site would continue under a long-term lease with the City of Oakland for recreational use (golf and a soccer field).
- Port/Landfill. Without the project, the Ninth Avenue Marine Terminal would continue as a cargo terminal for break bulk cargo. The three landfills considered under this disposal option would continue to operate as landfills.
- Montezuma Wetlands. Wetland restoration at this site, using dredged material from San Francisco Bay, is being proposed by Levine-Fricke independently of the Oakland Harbor deepening project. If permits are issued, it would likely be used as a sediment disposal site even if the Oakland Harbor project did not go forward.

The environmental impacts of the No-Action Alternative are described in Chapter 6.

2.4 SEDIMENT CHARACTERIZATION

Up to 6.6 mcy would be dredged from the Oakland Inner and Outer Harbors to construct the navigation improvement project. This volume includes deepening of the entire dredging area to -42 feet MLLW, and up to an additional 1 foot of overdredging to allow for inaccuracies in the dredging operation and to ensure that 42 feet is maintained during periodic maintenance events.

Representative samples of the material to be dredged have been collected and tested to determine its acceptability for various disposal options and potential uses. This section describes the suitability determination guidelines used in the evaluation process and defines the suitability of Oakland Harbor sediments for each disposal option or use. Note that the suitability categories described below are not mutually exclusive. Dredged material areas shown in Figures 2.4-1 through 2.4-3 were delineated based on sediment quality determinations on sediments sampled within each area. Figure 2.4-4 shows the locations of sediment samples in the proposed Inner Harbor Turning Basin. Table 2.4-1 presents the suitability of sediments analyzed within each area for each type of option/use. Table 2.4-2 shows the volume of each sediment sample that is proposed for specific disposal sites included in the preferred Alternative B2. For a detailed discussion of the chemical and biological testing results for the Oakland Harbor sediments and a rationale for suitability determinations by sample, see Appendix A. Complete discussions of the testing requirements and evaluative criteria under all applicable sampling and testing

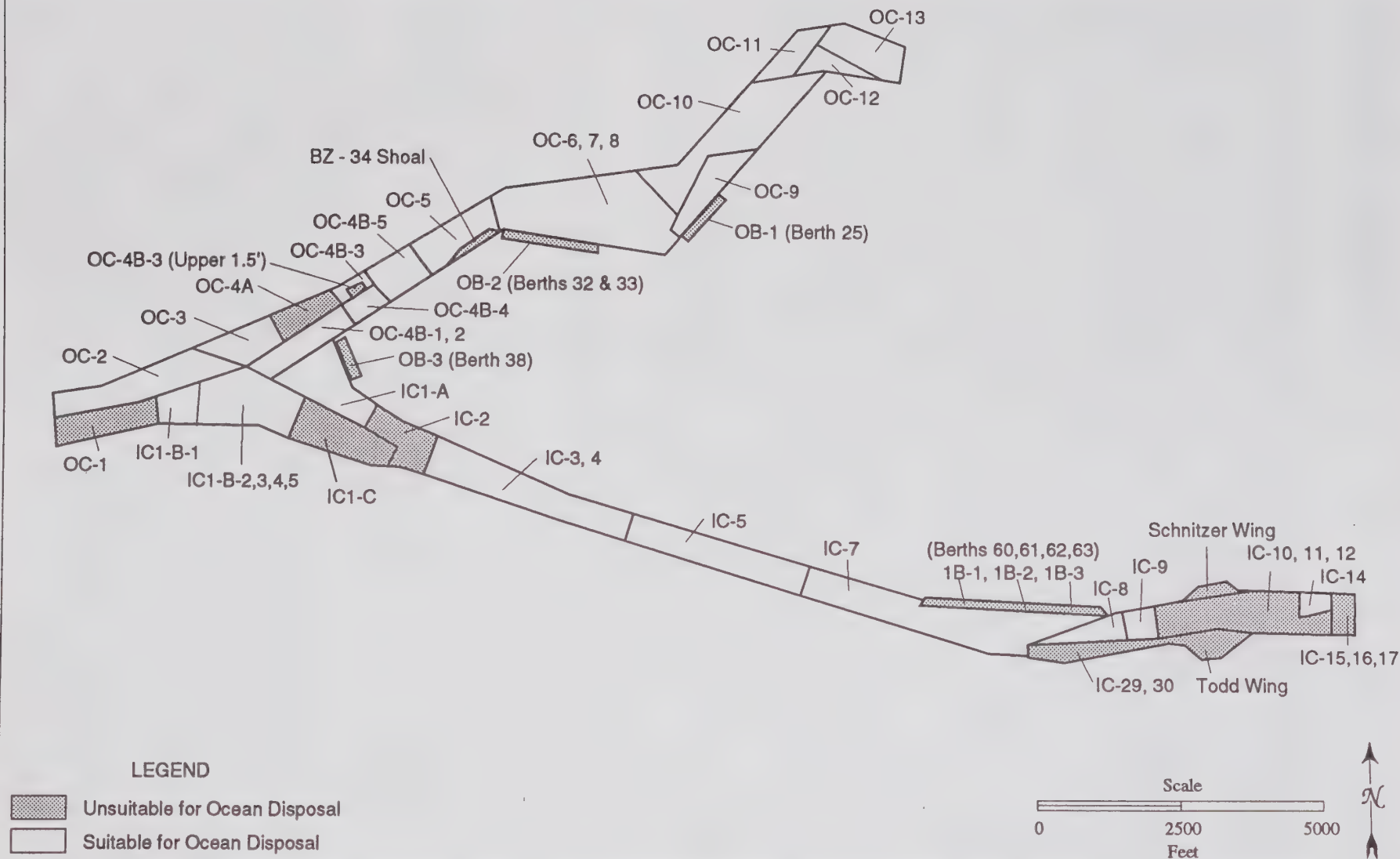


Figure 2.4-1

SEDIMENTS SUITABLE FOR OCEAN DISPOSAL

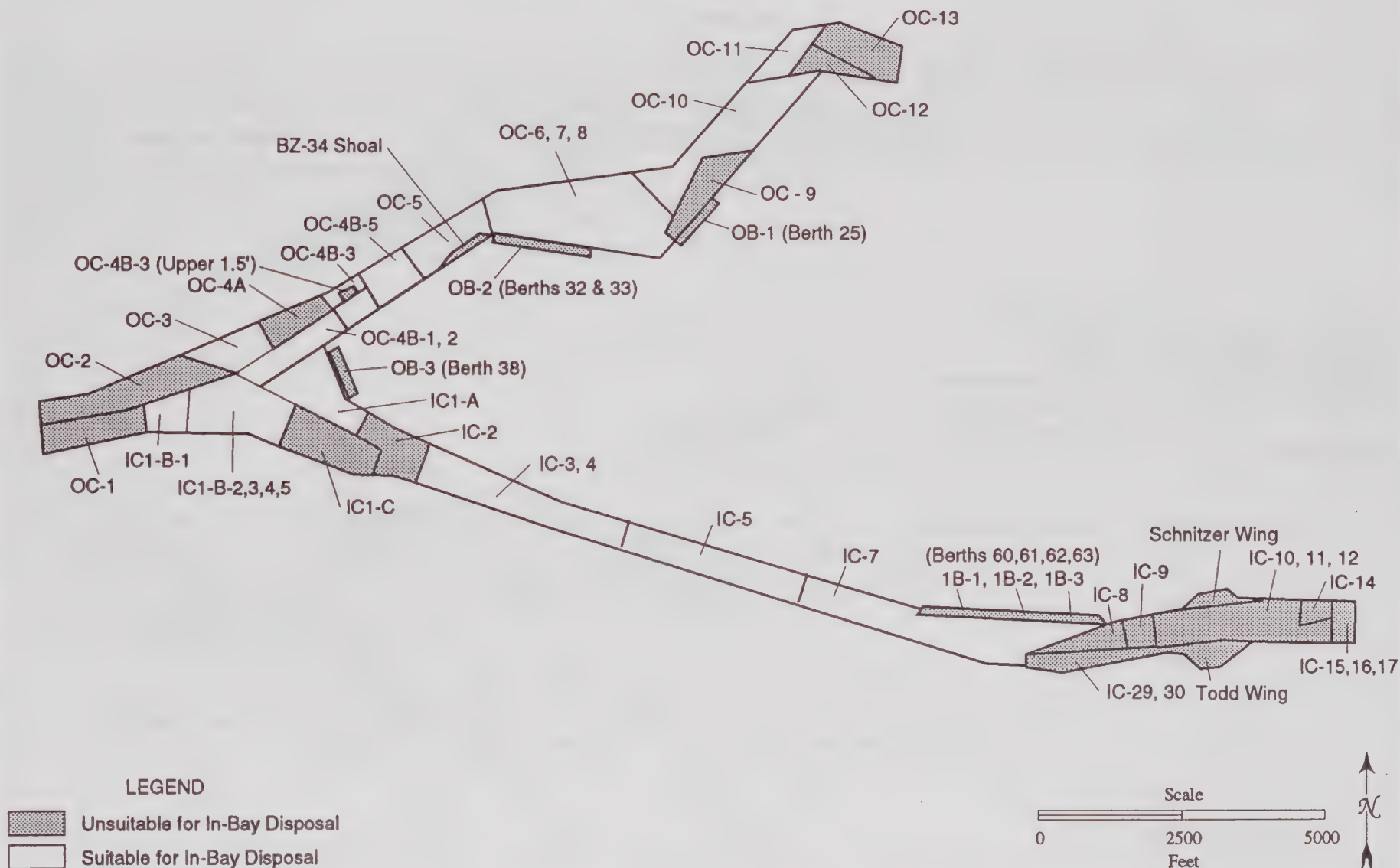


Figure 2.4-2

SEDIMENTS SUITABLE FOR IN-BAY DISPOSAL

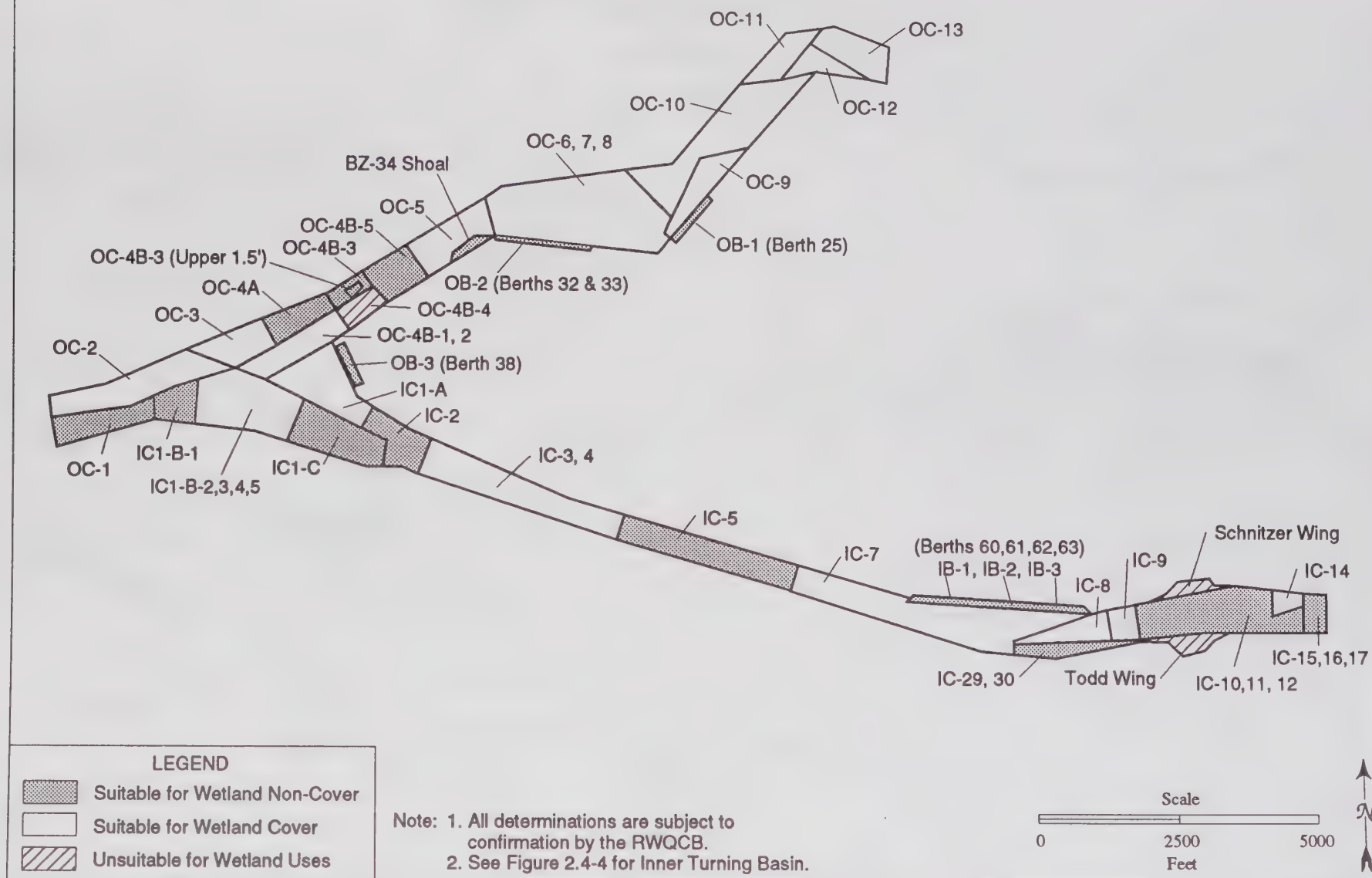
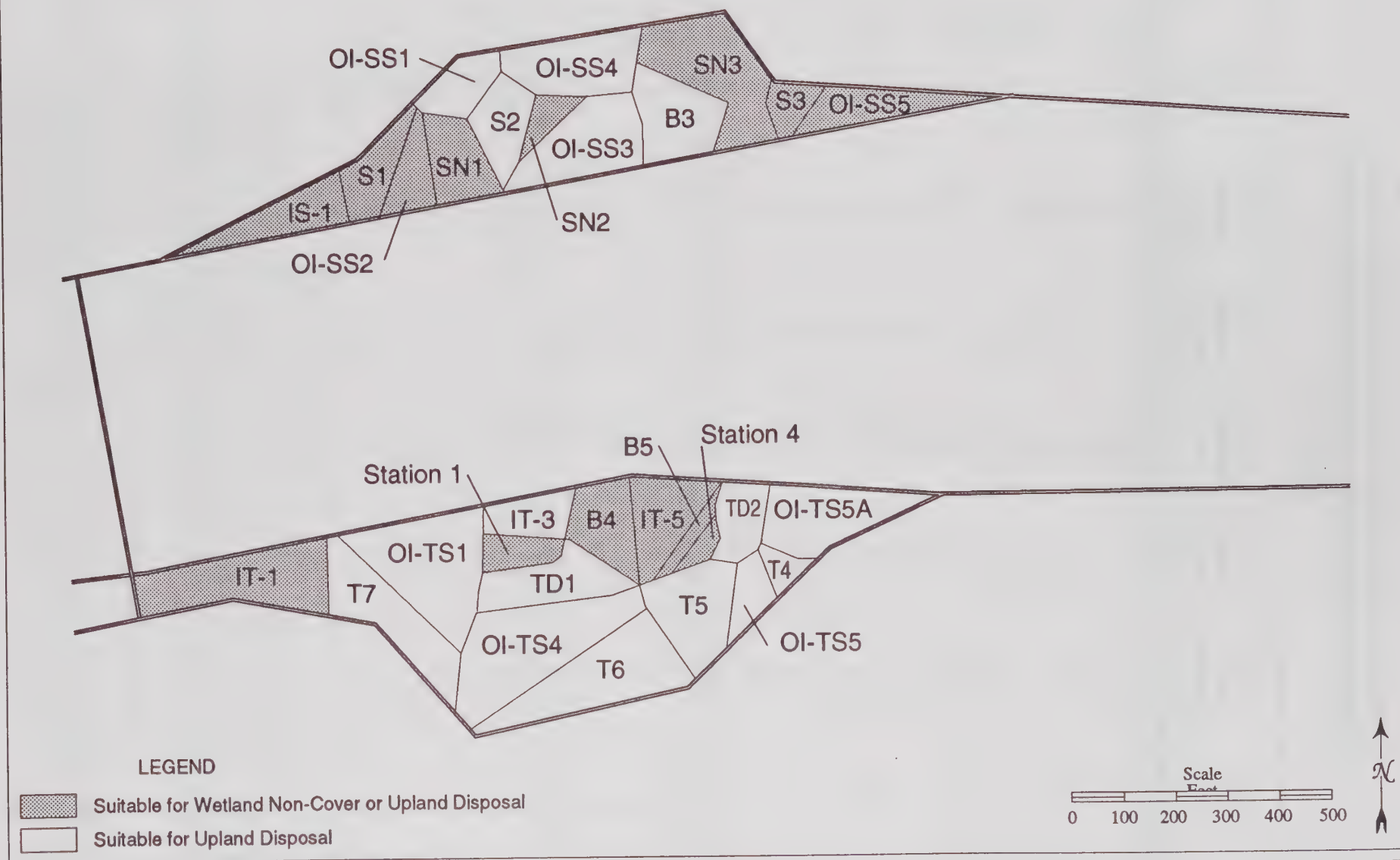


Figure 2.4-3

SEDIMENTS SUITABLE FOR DISPOSAL IN A WETLAND



**Table 2.4-1. Suitability of Oakland Harbor Sediments
for Various Disposal Options and Uses, by Sampling Location**
(page 1 of 2)

<i>Sample</i>	<i>Suitable Unconfined Ocean ¹</i>	<i>Suitable Unconfined Bay ²</i>	<i>Suitable Confined Bay Disposal ³</i>	<i>Suitable Wetland Cover ⁴</i>	<i>Suitable Wetland Non-Cover ⁵</i>	<i>Suitable Upland Disposal ⁶</i>	<i>Landfill Disposal ⁷</i>
Outer Harbor							
OC1			X		X	X	
OC2	X		X	X	X	X	
OC3	X	X	X#	X	X	X	
OC4A			X		X	X	
OC4B-1,2	X	X	X#	X	X	X	
OC4B-3	X	X	X		X	X	
OC4B-4	X	X	X#			X	
OC4B-5	X	X	X#		X	X	
OC5	X	X	X#	X	X	X	
OC6	X	X	X#	X	X	X	
OC7	X	X	X#	X	X	X	
OC8	X	X	X#	X	X	X	
OC9	X		X	X	X	X	
OC10	X	X	X#	X	X	X	
OC11	X	X	X#	X	X	X	
OC12	X		X	X	X	X	
OC13	X		X	X	X	X	
BZ-34 Shoal			X		X	X	
Inner Harbor							
IC1A	X	X	X#	X	X	X	
IC1B-2,3,4,5	X	X	X#	X	X	X	
IC1B-1	X	X	X#		X	X	
IC1C			X		X	X	
IC2			X		X	X	
IC3	X	X	X#	X	X	X	
IC4	X	X	X#	X	X	X	
IC5	X	X	X#		X	X	
IC7	X	X	X#	X	X	X	
IC8	X		X	X	X	X	
IC9	X		X	X	X	X	
IC10			X		X	X	
IC11			X		X	X	
IC12			X		X	X	
IC14	X		X	X	X	X	
IC15			X		X	X	
IC16			X		X	X	
IC17			X		X	X	
IC29			X		X	X	
IC30			X		X	X	
Inner Harbor Turning Basin							
B3A			X			X	
IS1			X		X	X	
S1			X		X	X	
S2			X			X	
S3			X		X	X	

**Table 2.4-1. Suitability of Oakland Harbor Sediments
for Various Disposal Options and Uses, by Sampling Location**
(page 2 of 2)

<i>Sample</i>	<i>Suitable Unconfined Ocean ¹</i>	<i>Suitable Unconfined Bay ²</i>	<i>Suitable Confined Bay Disposal ³</i>	<i>Suitable Wetland Cover ⁴</i>	<i>Suitable Wetland Non-Cover ⁵</i>	<i>Suitable Upland Disposal ⁶</i>	<i>Landfill Disposal ⁷</i>
Inner Harbor Turning Basin							
SN1			X		X	X	
SN2			X			X	
SN3			X		X	X	
OISS1			X			X	
OISS2			X		X	X	
OISS3			X			X	
OISS4			X		X	X	
OISS5			X		X	X	
B4A			X		X	X	
B5A			X		X	X	
STATION 1			X		X	X	
STATION 4			X		X	X	
IT1			X		X	X	
IT3			X		X	X	
IT5			X		X	X	
T4			X			X	
T5			X			X	
T6			X			X	
T7			X			X	
TD1			X			X	
TD2			X			X	
OITS1			X			X	
OITS4			X			X	
OITS5			X			X	
OITS5A			X			X	
Berths							
IB1 (Berth 60)			X		X	X	
IB2 (Berth 61)			X		X	X	
IB3 (Berth 62)			X		X	X	
IB4 (Berth 63)			X		X	X	
OB1 (Berth 25)			X		X	X	
OB2 (Berths 32 and 33)			X		X	X	
OB3 (Berth 38)			X		X	X	

- Notes:**
- As determined by the USEPA and discussed in Appendix A. Merritt sands underlying sediments that are suitable for unconfined ocean disposal are considered acceptable for ocean disposal (see U.S. EPA comment letter, Appendix M).
 - As determined by the USEPA and discussed in Appendix A. Merritt Sands underlying sediments that are unsuitable for unconfined bay disposal are considered acceptable for bay disposal (U.S. EPA comment letter on DSEIR/S; see Appendix M).
 - # Denotes sediments suitable for use as capping material.
 - Subject to confirmation by the RWQCB.
 - As determined on the basis of comparison to the wetland non-cover chemical criteria (RWQCB 1992) (except chromium).
 - As determined based upon analysis conducted by the Waterways Experiment Station regarding contaminant migration via effluent, surface runoff, leachate and plant and animal uptake (Lee 1991, 1992).
 - The RWQCB has determined that with adequate upland containment measures, no sediments will require landfill disposal (see RWQCB comment letter on the Draft SEIR/S).

Table 2.4-2. Volumes of Sediment Samples Proposed for the Ocean, Sonoma Baylands, and Galbraith Sites Under the Preferred Alternative B2 (Updated 5/12/94)
(page 1 of 3)

<i>Sample Number</i>	<i>Sediment Volume in Cubic Yards ¹</i>		
	<i>Ocean Section 102</i>	<i>Sonoma Baylands</i>	<i>Galbraith Golf Course</i>
OUTER HARBOR			
OC1 (soft) ²			50,000
OC2 (soft)		311,000	
OC3 (soft)		151,000	
OC3 (hard) ³	20,000		
OC4A (soft)			21,000
OC4A (hard)	90,000		
OC4B-1,2 (soft)	34,000		
OC4B-1,2 (hard)	15,000		
OC4B-3 (1.5' soft)			2,000
OC4B-3 (1.5' hard)	4,000		
OC4B-3 (soft)	8,000		
OC4B-3 (hard)	28,000		
OC4B-4 (soft)	21,000		
OC4B-4 (hard)	19,000		
OC4B-5 (soft)	97,000		
OC4B-5 (hard)	9,000		
OC5 (soft)		159,000	
OC5 (hard)	85,000		
OC6,7,8 (soft)		733,000	
OC6,7,8 (hard)	91,000		
OC9 (soft)		15,000	
OC9 (hard)	63,000		
OC10 (soft)		245,000	
OC10 (hard)	172,000		
OC11 (soft)		132,000	

Table 2.4-2. Volumes of Sediment Samples Proposed for the Ocean, Sonoma Baylands, and Galbraith Sites Under the Preferred Alternative B2 (Updated 5/12/94)
(page 2 of 3)

<i>Sample Number</i>	<i>Sediment Volume in Cubic Yards ¹</i>		
	<i>Ocean Section 102</i>	<i>Sonoma Baylands</i>	<i>Galbraith Golf Course</i>
OC11 (hard)	30,000		
OC12 (soft)		119,000	
OC12 (hard)	49,000		
OC13 (soft)		87,000	
OC13 (hard)	145,000		
BZ-34 shoal (soft)			30,000
BZ-34 shoal (hard)	9,000		
INNER HARBOR			
IC1A (soft)	103,000		
IC1A (hard)	165,000		
IC1B-2,3,4,5 (soft)		232,000	
IC1B-1 (soft)	63,000		
IC1C (soft)			142,000
IC2 (soft)			104,000
IC3,4 PART (soft)		272,000	
IC3,4 REM. (soft)	242,000		
IC3,4 (hard)	27,000		
IC7 (soft)	303,000		
IC7 (hard)	301,000		
IC5 (soft)	281,000		
IC8 (soft)	43,000		
IC8 (hard)	46,000		
IC9 (soft)		44,000	
IC9 (hard)	4,000		
IC10,11,12 (soft)			219,000
IC10,11,12 (hard)	146,000		

Table 2.4-2. Volumes of Sediment Samples Proposed for the Ocean, Sonoma Baylands, and Galbraith Sites Under the Preferred Alternative B2 (Updated 5/12/94)
(page 3 of 3)

<i>Sample Number</i>	<i>Sediment Volume in Cubic Yards ¹</i>		
	<i>Ocean Section 102</i>	<i>Sonoma Baylands</i>	<i>Galbraith Golf Course</i>
IC14 (soft)	12,000		
IC14 (hard)	34,000		
IC15,16,17 (soft)			44,000
IC15,16,17 (hard)	33,000		
IC29,30 (soft)			105,000
IC29,30 (hard)	46,000		
TURNING BASIN WINGS			
North (soft)			114,000
North (hard)			8,000
South (soft)			97,000
South (hard)			96,000
BERTHS			
B60-63 (soft)			42,000
B60-63 (hard)	39,000		
OB1 berth 25 (soft)			12,000
OB1 (hard)	6,000		
OB2 berths 32&33			68,000
OB2 (hard)	18,000		
OB3 berth 38 (soft)			9,000
TOTAL	2,901,000	2,500,000	1,163,000

- Notes:
1. Sediment volumes are rounded to the nearest thousand cubic yards.
 2. "Soft" refers to the unconsolidated material above the Merritt sand formation.
 3. "Hard" refers to the Merritt sand formation.
- Assumptions:
1. Volumes based on COE 5/10/94 estimates.
 2. Volumes include Sonoma Baylands' volumes based on COE's 4/15/94 estimates.

regulations are presented in section 4.2.2 and 4.4.1 for water and biological impact evaluations, respectively. The testing results are presented in sections 4.2.3 and 4.4.2 for water and biological impact evaluations, respectively. The implications of the testing results for environmental impacts for each of the disposal sites are addressed in each separate site description by significant resource (section 4.2.7 -- water; section 4.3.4 -- sediment; section 4.4.4 -- biology).

2.4.1 Determination of Sediment Suitability for Aquatic and Non-Aquatic Disposal

The dredged material has been separated into three main categories: sediments suitable for aquatic disposal (i.e., ocean or in-Bay), sediments suitable for wetland creation, and sediments suitable for upland disposal. Within these main categories, the sediments are separated into the following categories that, as noted above, are not mutually exclusive:

- Sediments suitable for unconfined ocean disposal;
- Sediments suitable for unconfined in-Bay disposal;
- Sediments suitable for confined in-Bay disposal;
- Sediments suitable for wetland cover material;
- Sediments suitable for non-cover material;
- Sediments suitable for upland disposal; and
- Sediments suitable for restricted upland disposal (i.e., landfill).

The amount of sediment estimated to be in the categories above, and the criteria used to make that determination, are described below.

Sediments Suitable for Ocean Disposal

The suitability of dredged material for ocean disposal is regulated under the MPRSA. Under that act, suitability is determined by a comparison of the results of bioassays and bioaccumulation tests of the sediments to be dredged to results of the same tests with ocean sediments in accordance with the Implementation Manual ("Green Book") (COE/EPA 1991). The EPA and the Corps are responsible for reviewing the test data and determining acceptability for ocean disposal. Those agencies have determined that approximately 5.4 mcy of sediments from this project are acceptable for unconfined ocean disposal. Further detailed discussion of this topic is presented in Appendix A.

Sediments Suitable for In-Bay Disposal

The suitability of dredged material for disposal in San Francisco Bay is regulated under the CWA by the Corps and EPA, the San Francisco Bay Conservation and Development Commission (BCDC), and the Regional Water Quality Control Board (RWQCB). Those four agencies have prepared guidance under the CWA that specifically addresses disposal at the Alcatraz aquatic disposal site, which was published by the Corps as Public Notice 93-2 (COE 1993). Suitability of sediments for Bay disposal is based on a tiered approach that evaluates the sediment chemistry and comparison of the solid phase bioassay and bioaccumulation results to the same tests of Bay sediments near the Alcatraz disposal site. The Corps and EPA have determined that under this criteria, 4.8 mcy are suitable for Bay disposal. Further detailed discussion of this topic is presented in Appendix A.

Sediments Suitable for Use as Cover in a Wetland

The RWQCB has developed interim screening criteria and testing requirements for wetland creation and upland beneficial reuse of dredged material (RWQCB 1992). According to these interim criteria, suitability of material for use as cover material in a wetland restoration or creation project is determined by solid phase bioassay and leachate test results, and a comparison of contaminant concentrations in the dredged sediment to set levels for heavy metals, polychlorinated biphenyls (PCBs), DDT and derivatives, and polycyclic aromatic hydrocarbons (PAHs).

A comparison of the sediment analytical data for the material suitable for ocean disposal to the RWQCB interim sediment screening criteria shows that approximately 3.2 mcy of the dredged material could be considered for use as wetlands cover. This determination was made excluding chromium as a criterion. If chromium is used in the determination, only 0.2 mcy are suitable for wetland cover. The Port and Corps have determined that the chromium criterion is not appropriate for evaluating Oakland Harbor sediments because the chromium present is of natural origin (except for localized areas in the vicinity of former dry dock operations). While the chromium detected is biologically available, the naturally occurring chromium has not been toxic to test organisms in laboratory tests. For a more detailed discussion of the chromium issue, see section 4.2.7.5.

In addition, the EPA/Corps have developed a technical framework for evaluating the environmental effects of dredged material management alternatives that considers contaminant migration pathways (EPA/COE 1992). Specific tests have been developed over the past 20 years to determine the potential for contaminant migration. Lee et al. (1991) reports on the evaluation of creating wetlands with Oakland Harbor sediments in accordance with this framework. Details of these tests are described in Appendix K. Based on Lee's evaluation of wetland creation with Oakland sediments, test results for a composite sample of Oakland Outer Harbor sediment indicated plants and animals (snails and mussels) would contain similar amounts of contaminants as those collected from and exposed to existing wetland sediments around the San Francisco Bay (Lee et al. 1991).

Lee's evaluation showed that sediments from the Oakland Inner Harbor may not be suitable for use as wetland cover, but since these tests were conducted, it has been determined that only material that has been found suitable for wetland cover and unconfined ocean disposal will be proposed for wetland creation/restoration. Some of the sediments tested by the WES included material that has recently been determined to be unsuitable for unconfined aquatic disposal and/or unsuitable for wetland cover according to the RWQCB's interim sediment screening criteria. Consequently, the WES test results may be conservative and overestimate bioaccumulation in wetland plants and animals. Even so, Oakland Outer Harbor sediments produced plants and animals similar to those in existing wetlands in all but one case, and therefore these sediments were recommended for use in wetland creation/restoration. It is reasonable to assume that by removing the more highly contaminated material from the material disposed at Sonoma Baylands, the levels of bioaccumulation in wetland species would also decrease. In short, the wetland restoration project with the proposed Oakland material should result in wetland conditions with equal or perhaps less bioaccumulation potential than existing natural wetlands in the San Francisco Bay area. Lee et al. (1991) concluded that sediments from the entire Oakland Outer Harbor appeared to be suitable for wetland cover.

1 Sediments Suitable for Use as Non-Cover in a Wetland

2
3 For sediments that would be used as non-cover material (i.e., material to be buried 3 feet or more under
4 cover material in a wetland creation or restoration project), suitability is determined according to the
5 RWQCB's interim sediment screening criteria (RWQCB 1992). Approximately 6.3 mcy of materials for
6 this project are considered suitable for use as non-cover material in a wetland, again without reference
7 to the chromium criterion. This determination is subject to confirmation by the RWQCB.

8
9 Based on Lee's 1991 report, Oakland Outer Harbor sediments could be used for non-cover and Oakland
10 Inner Harbor sediments could be used in wetland creation, but with some restrictions such as capping the
11 non-cover material with suitable cover material.

12
13 Sediments Suitable for Upland Disposal

14
15 There are no general suitability criteria for sediments proposed for use as fill or to be dried at a
16 rehandling facility. The EPA and the Corps have developed a technical framework to evaluate disposal
17 of sediments/dredged material in upland disposal environments (EPA/COE 1992). The basis of this
18 framework includes 20 years of research and development and test results for dredged materials from
19 each part of this nation, including Oakland Harbor sediments. According to this framework, specific test
20 procedures were developed and field verified for specific pathways of contaminant migration at a disposal
21 site. The contaminant pathways evaluated for upland placement of Oakland Harbor sediments were
22 effluent, surface runoff, leachate, plant and animal uptake (Lee et al. 1992; 1993). The suitability and
23 management of Oakland Harbor sediments under an upland disposal environment were evaluated and
24 recommendations were made based on test results. Further details of this evaluation are discussed in
25 sections 4.2.2 and 4.4.

26
27 Sediments Suitable for Restricted Upland Disposal

28
29 The EPA/Corps technical framework was developed and is used for evaluating the suitability of sediment
30 for upland disposal. Lee et al. (1992) and Lee et al. (1993) conducted comprehensive evaluations of
31 upland disposal of sediments from Oakland Inner and Outer Harbors and the proposed Inner Harbor
32 turning basin. These evaluations describe contaminant test results for effluent, surface runoff, leachate,
33 and plant and animal uptake under upland conditions. All sediments from Oakland Harbor are suitable
34 for upland disposal with appropriate management and control of contaminant migration on a site-specific
35 basis. A more detailed discussion of these evaluations is found in sections 4.2.2 and 4.4.

36
37 The RWQCB evaluates upland disposal suitability based on site-specific characteristics and on a case-by-
38 case basis. The RWQCB is currently evaluating whether any of the sediments to be dredged from the
39 Inner Harbor turning basin wing areas are unsuitable for upland disposal, except in a landfill. If any
40 sediments fall into this category, they will be disposed in a landfill. Suitability for landfill disposal is
41 determined by the acceptance criteria of each landfill, which also depends on site-specific characteristics.

42
43 Suitability of sediments for use as a daily cover at a landfill is determined on the basis of sediment
44 chemistry and organic carbon concentrations (RWQCB 1992) and by the operator of the landfill. Because
45 the requirements of the landfills differ, a determination has not been made regarding the volume of
46 material suitable for this use.

Proposed Action and Alternatives

Dredged material would be considered hazardous and require disposal in a Class I landfill if the material contained contaminant concentrations greater than those listed in Title 22, California Code of Regulations Section 66261.24. None of the material to be dredged for construction of this project has been determined to be hazardous under Title 22 criteria.

2.5 DREDGED MATERIAL DISPOSAL OPTIONS

Twenty-three (23) dredged material disposal options were initially considered for the proposed project, including six aquatic sites and 17 upland sites (see Figure 2.5-1). Some of these disposal options included more than one site, as noted below.

Aquatic Sites

Alameda Gateway
Alcatraz Disposal Site
Bay Farm Borrow Area
Ocean Section 102 site
Ocean site (B1B)
San Pablo Bay

Upland Sites

Cargill East	Port (Ninth Avenue Terminal), in connection with:
Cargill West Wetlands	- West Contra Costa Landfill
Cullinan Ranch	- Vasco Road Sanitary Landfill
Galbraith Golf Course	- East Carbon Development Corporation Landfill
Hamilton Antenna Field	Port Sonoma-Marin
Leonard Ranch, in connection with:	Praxis/Pacheco
- Redwood Landfill	Richmond Dry Docks
Levee Repair	San Leandro Drying Ponds
- Lower Jones Tract	Skaggs Island
- Twitchell Island	Sonoma Baylands
Mare Island	
Montezuma Wetlands	

Some of these sites were subsequently eliminated from further consideration, as explained in section 2.6.

If any of the sediments are determined by the RWQCB to be unsuitable for upland disposal, the sediments would be disposed of in a suitable sanitary landfill. As suggested above, the Port/Landfill disposal option includes three possible landfills. As the sediments would have to be dried before transport to the landfills, a drying yard would be constructed at the site of the Ninth Avenue Terminal on Port property. To identify the landfill part of this disposal option, the Port sent a questionnaire to 21 Class II and III landfills in the general Bay Area and one in Utah requesting that the landfills respond if they were interested in and able to accept this material. From the favorable responses, the Port selected the following three landfills for future consideration, based on the anticipated tipping fees (i.e., disposal fees) and haul distance:

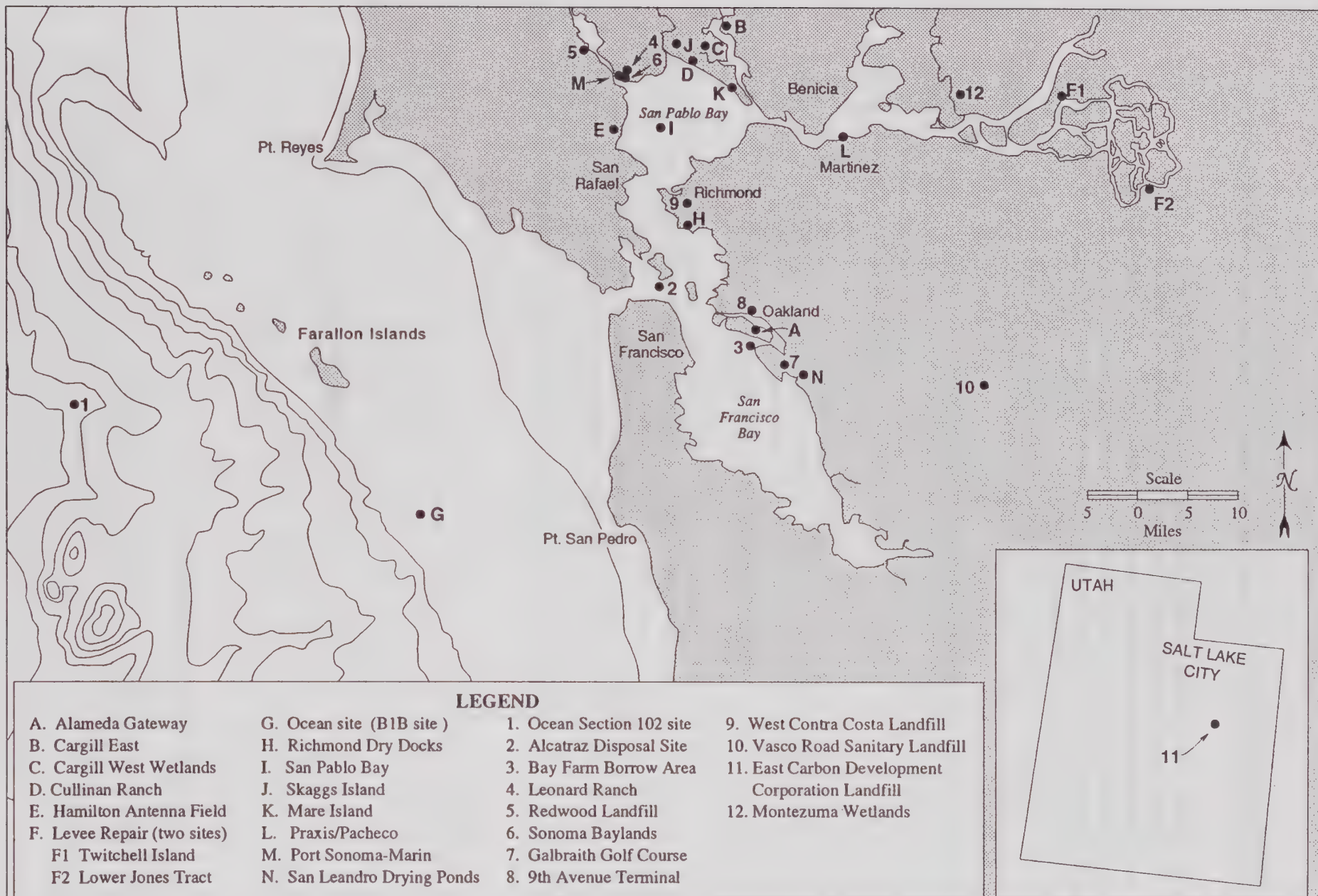


Figure 2.5-1

DREDGED MATERIAL DISPOSAL OPTIONS INITIALLY CONSIDERED

Proposed Action and Alternatives

- West Contra Costa Landfill in Richmond, California (Class III);
- Vasco Road Sanitary Landfill in Livermore, California (Class III); and
- East Carbon Development Corporation in Carbon County, Utah (Class II).

This upland disposal option, if required (that could include one, two, or all three of the above landfills), is referred to in the document as Port/Landfill (see section 2.7.7).

2.6 DREDGED MATERIAL DISPOSAL SITES ELIMINATED FROM FURTHER STUDY

This section explains why certain potential dredged material disposal sites have been eliminated from further study. First, however, the following points serve to put in perspective the disposal site selection process described below. It has been 22 years since Congress authorized a study of navigation in the Oakland Harbor area and eight years since Congress authorized construction of the Oakland Harbor navigation improvement project. The disposal site selection process has been long and demanding and, in the interim, the Port of Oakland has lost West Coast market share. Also, the President of the United States (in a speech to the people of Oakland in August 1993) directed that this Oakland Harbor project be started by December 1994. In sum, a long planning process has preceded this project, the proposed deepening is critically needed now, thus any disposal options that cannot meet the Oakland Harbor project schedule have been eliminated.

The Corps and Port have considered a number of potential disposal sites for the sediments to be dredged for this project. The sites considered include a number of sites recommended by the LTMS as highly feasible (Moffatt & Nichol 1993), as well as over 30 sites considered in a previous study (Tetra Tech, Inc. 1990) for disposal of sediments that were excavated during the construction of most of the Inner Harbor channel to -38 feet MLLW. The latter study screened sites based upon capacity, engineering constraints, ownership, and ability to receive material within the timeframe of the proposed dredging project.

2.6.1 Potential Aquatic Sites

2.6.1.1 Ocean Site B1B

Ocean site B1B is located in Study Area 2 of the EPA Final EIS ocean disposal site study. The BIB site is located in the Monterey Bay Sanctuary. This site was eliminated because it was not considered viable when a Section 102 (MPRSA) site is available, and because EPA has withdrawn its approval of this site as a designated disposal site.

2.6.1.2 San Pablo Bay

This site was eliminated because its capacity is very limited.

2.6.1.3 Alameda Gateway

This site was eliminated because its use for sediment disposal would not be consistent with the BCDC *Bay Plan*.

2.6.2 Potential Wetland Restoration/Enhancement Sites

All the sites listed below have been identified by the LTMS as highly feasible habitat enhancement sites within the 50-year timeframe of the LTMS (Moffatt & Nichol 1993). However, detailed implementation plans have not been developed for any of these sites to identify the volume of dredged material needed or the placement of that material. Once those plans are developed, use of dredged material on these sites will be limited to sediments that are suitable for wetland uses. Well over a year is typically required to develop these plans and obtain permits. To prevent further erosion of Oakland's share of the West Coast cargo market, the Oakland Harbor must be deepened as soon as possible. Because these sites are not yet available to accept dredged material, and because other wetland enhancement sites are being evaluated for this project, these sites were eliminated from detailed consideration for this project.

2.6.2.1 Cargill West Wetlands

A sale agreement of this approximately 10,000-acre site in Napa County from Cargill Salt for habitat enhancement negotiated by a committee composed of federal and state resource management agencies was approved in February 1994. The property could thus become public land in the near future. The LTMS has prepared a concept-level implementation plan for this site. Almost the entire Cargill West site is presumptive Section 404 jurisdiction and supports substantial wildlife resources in its existing condition. Preliminary engineering feasibility studies developed through the LTMS Upland/Reuse Studies have estimated that between 7 mcy and 11.4 mcy of dredged material could be used for wetland restoration at this site (EPA 5/2/94 comment letter on the DSEIR/S). If this site were used for dredged material disposal, the impacts on wetlands would require mitigation. In addition, the Bay Conservation and Development Commission *Bay Plan* has specific policies on the preservation of salt ponds. The ponds at this site are not significantly subsided and would have little need for dredged materials if tidal restoration were pursued. It is unknown when this site might be available for dredged material disposal.

2.6.2.2 Cullinan Ranch

This approximately 1,500-acre site in Solano County has been purchased by the U.S. Fish and Wildlife (USFWS) for habitat enhancement. The USFWS is preparing an implementation plan that may or may not include dredged material. The scheduled completion date for the implementation plan is unknown.

2.6.2.3 Hamilton North Antenna Field

This approximately 300-acre site in Marin County is owned by the State of California, which has proposed to use it for habitat enhancement. An implementation plan has not yet been prepared.

2.6.2.4 Skaggs Island

This 4,310-acre site in Sonoma County currently is owned by the U.S. Navy, but is no longer needed. The USFWS is investigating the possibility of obtaining the site for habitat restoration. Preliminary engineering feasibility studies developed through the LTMS Upland/Reuse Studies have estimated that up to 16.1 mcy of dredged material could be used for wetland restoration at this site (EPA 5/2/94 comment letter on the DSEIR/S). This site was also considered undesirable because of a 7- to 9-mile-long pipeline through multiple ownership properties (including wetlands) that would be necessary if this site were selected. It is unknown when this site might be available for dredged material disposal.

2.6.3 Potential Confined Disposal Sites

2.6.3.1 Cargill East

This 1,125-acre site in Napa County has been identified by the LTMS as a highly feasible site for both confined disposal and a sediment reprocessing facility (Moffatt & Nichol 1993). Although a reconnaissance level design and cost estimate have been prepared for the site (Gahagan & Bryant Associates 1992), the unresolved Clean Water Act jurisdictional issues associated with it, and the estimated cost of site acquisition and preparation (\$13.2 million) make the site infeasible for use for Oakland project material. Use of this site is being pursued through the LTMS study as a regional facility.

2.6.3.2 Richmond Dry Docks

These five dry docks in the Richmond Harbor in Contra Costa County were initially considered as a possible confinement site for Oakland sediments. However, the site is now being considered for disposal of contaminated sediments associated with both an EPA Superfund site cleanup and with the Port of Richmond Deepening Project, and is thus not available for use for the Oakland project.

2.6.3.3 Partial Use of the Galbraith Site

The Port considered use of only a limited portion of the 169-acre Galbraith Golf Course for disposal of the sediments that are unsuitable for unconfined aquatic disposal. Because of the volume of this material to be dredged for construction of the project, 1.3 mcy, almost the entire site would be necessary to dry and confine the sediments. The option was thus eliminated from detailed analysis.

2.6.3.4 Mare Island Shipyard Disposal Ponds

The Port considered use of the existing dredged material disposal ponds at the Mare Island Naval Shipyard in Solano County. The Navy indicates that approximately 1 mcy of dry volume of disposal capacity will be available for use in 1996 when the Navy is scheduled to vacate the facility (Kennedy 1993). The future use of the facility after the Navy leaves will be determined by the Mare Island Future Committee, which has not yet developed a Community Reuse Plan. Once that plan is completed, the Navy will prepare an Environmental Impact Statement on the Reuse Plan. Because a decision has not been made regarding future use of the ponds and, even if the decision is made to accept dredged material, the ponds would not be available in time for use of the Oakland project, this disposal option was eliminated from detailed consideration.

2.6.4 Potential Reprocessing Facilities

2.6.4.1 Praxis/Pacheco

This 165-acre site in Contra Costa County has been identified by the LTMS as a highly feasible reprocessing facility. The LTMS has prepared a reconnaissance level design and cost estimate (Gahagan & Bryant Associates 1992). Of the three sites studied in this category by the LTMS (Cargill East, Leonard Ranch, Praxis/Pacheco), this site is the least feasible to implement. It has the lowest capacity (400,000 cy per 2-year cycle), and the development cost per cubic yard of dredged material handled is the highest. Site development costs are estimated at \$19.5 million. Additionally, mitigation costs per

acre are the highest of the three sites evaluated. For these reasons, this site was eliminated from detailed consideration for the Oakland project.

2.6.4.2 Port Sonoma-Marin

This approximately 30-acre site in Sonoma County is used by the Port of Sonoma-Marin to dry sediment dredged from the marina. It is identified by the LTMS as a highly feasible reprocessing facility. The site has also been used on a limited basis to dry sediments dredged from the Ports of Oakland and San Francisco. All of these sediments are hauled once dry to the Redwood Landfill in Marin County. The small size of this facility limits its capacity to approximately 250,000 cy of sediment at one time. Most of the capacity is used by the marina itself. This facility was thus eliminated from detailed consideration for this project because of the limited capacity available.

2.6.4.3 San Leandro Disposal Ponds

The City of San Leandro operates an approximately 100-acre dredged material disposal pond to dry out sediments dredged from the San Leandro municipal marina and the federal channel to that marina. The site is used approximately every 4 years. The City is required under an order from the RWQCB to remove the dried dredged sediments and manage the site for shorebird habitat between disposal episodes. Recently the City of San Leandro has started a program to remove dry sediments from the site, which are trucked to a landfill in Fremont. Because of the constraints regarding the use of the site, and the fact that the dry dredged material would have to be trucked through residential neighborhoods, this site was eliminated from detailed consideration.

2.6.5 Potential Levee Repair Sites

Two levee repair sites in the Sacramento-San Joaquin Delta were proposed and evaluated previously by the Port as potential disposal options for Phase I deepening of the Oakland project: Twitchell Island in Sacramento County and Lower Jones Track in San Joaquin County (Port 1989). Although the Port was successful in obtaining a permit from the Central Valley RWQCB for disposal of Phase I sediments, the RWQCB was concerned about the water quality impacts of the use of sediments from a salt water environment in the fresh-water Delta. The Port abandoned its attempt at Delta disposal in 1990 because of the costs and time that would be required to comply with the permit conditions of the Central Valley RWQCB and the escalating testing and monitoring requirements of Sacramento and San Joaquin counties.

2.7 DREDGED MATERIAL DISPOSAL SITES CONSIDERED FOR FURTHER STUDY

After the elimination of disposal options described in section 2.6, eight disposal options remained for further consideration, some of which consist of more than one site (e.g., Leonard Ranch, and the Port site at Ninth Avenue Marine Terminal). The eight disposal options include three aquatic sites and three upland sites and two wetland restoration sites. These sites are shown in Figure 2.7-1 and described below. The type of sediment that would be disposed at each site is summarized in Table 2.7-1. The amount of dredged sediment that would be disposed at each site depends on the disposal alternative considered (see section 2.8). An almost unlimited combination of disposal plans are possible by varying slightly the volume of sediments proposed for each disposal site. The alternatives selected for detailed analysis in this document were selected to encompass the range of possible combinations.

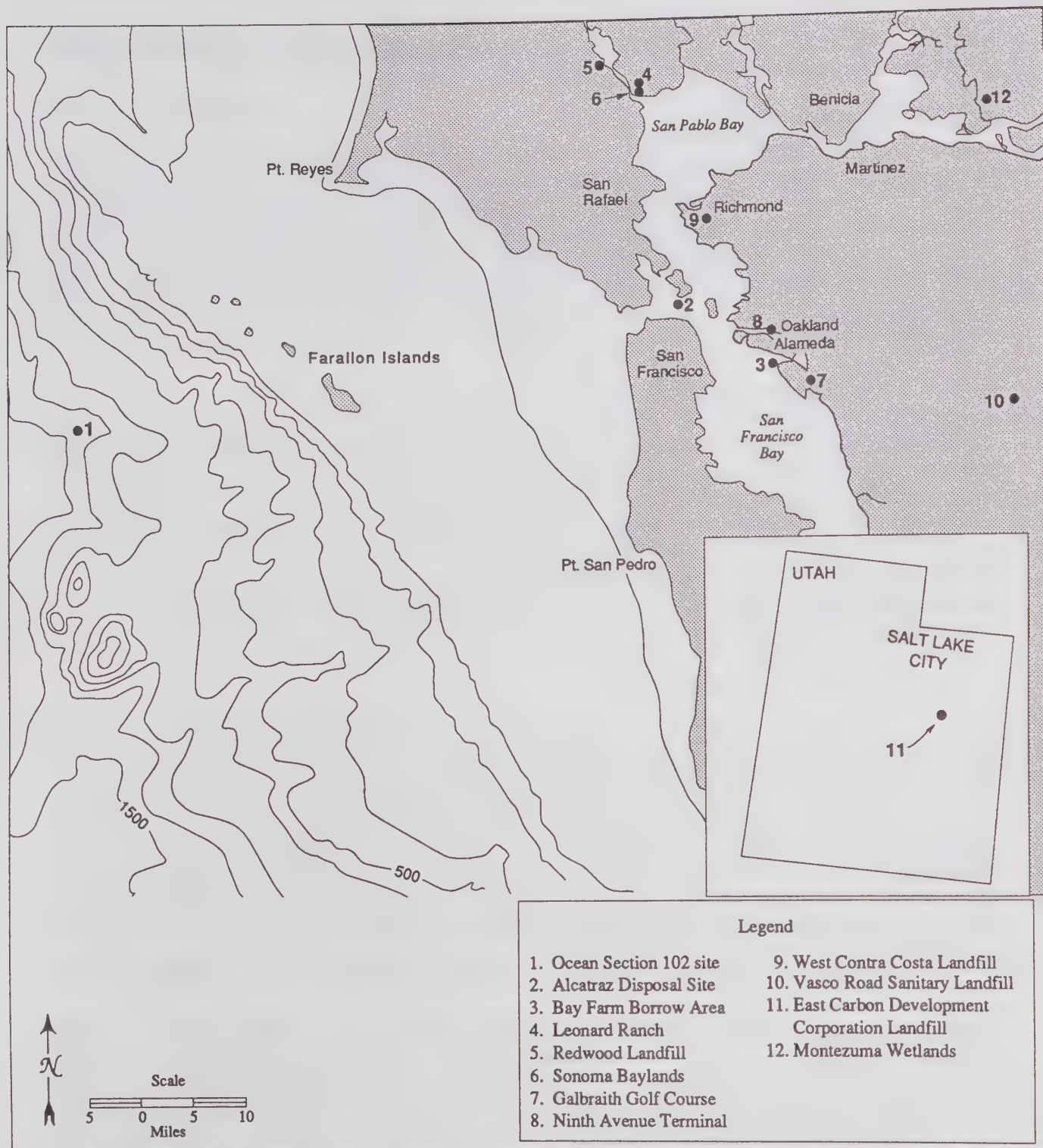


Figure 2.7-1

DREDGED MATERIAL DISPOSAL SITES EVALUATED IN DETAIL

Table 2.7-1. Suitability of Oakland Harbor Sediments for Various Disposal Options

	Dredged Material Disposal Sites							
Sediment Categories*	Ocean Section 102 Site	Alcatraz	Bay Farm Borrow Area	Leonard Ranch/ Redwood Landfill	Sonoma Baylands	Galbraith Golf Course	Port/ Landfill	Montezuma Wetlands
Suitable for Unconfined Ocean Disposal	X							
Suitable for Unconfined In-Bay Disposal		X	X					
Suitable for Confined In-Bay Disposal			X					
Suitable for Wetland Cover					X			X
Suitable for Wetland Non-Cover								X
Suitable for Upland Disposal				X		X		
Requires Landfill Disposal							X	

Note: *Sediment categories are not mutually exclusive.

2.7.1 Ocean Section 102

The EPA-proposed Ocean Section 102 site is shown in Figure 2.7.1-1. It is the same site as Alternative Site 5 in the EPA Final EIS; any mention of Alternative Site 5 in this document refers to the Ocean Section 102 site. Up to 5.4 mcy of sediment could be disposed at this site, depending on the disposal alternative selected. Disposal at this site would require one clamshell dredge, two tugs, and four dump scows. Sediments would be released by bottom dump barge. Use of this ocean site is contingent upon EPA's final rule on the Ocean Section 102 (MPRSA) site designation, which is currently expected in June 1994. This site would not be used for dredged material disposal from the Oakland Harbor project until this EPA rule making is finalized. EPA's proposed rule on the Ocean Section 102 (MPRSA) site designation was published in the *Federal Register* on February 17, 1994 (EPA 1994a). Public Notice of the EPA's proposed Site Management and Monitoring Plan for the Ocean site was issued on April 20, 1994 (EPA 1994b).

2.7.2 Alcatraz

The Alcatraz disposal site is shown in Figure 2.7.2-1. Up to 4.8 mcy of sediment could be disposed of at this site, depending on the disposal alternative selected. Disposal at this site would require one clamshell dredge, two tugs, and three dump scows. Sediments would be released by bottom dump barge. There are monthly and annual "target restrictions" on the amount of sediment that can be disposed of at this site. The annual restriction is 4 mcy. The monthly restriction is 400,000 cy from October through April, and 300,000 cy from May through September; during either of these two periods, no more than 150,000 cy may be clamshelled material. Many other projects compete for the available disposal capacity at this site.

2.7.3 Bay Farm Borrow Area

The Bay Farm Borrow Area is shown in Figure 2.7.3-1. Either 4.8 or 6.6 mcy of sediment could be disposed of at this site, depending on the disposal alternative selected. Disposal at this site would require one clamshell dredge, two tugs, three dump scows, and possibly a pump-out barge. Sediments disposed at the Bay Farm Borrow Area (BFBA) would be released by controlled, submerged pipelines and/or directly from dump scows, depending on the disposal alternative selected. For confined disposal, unsuitable material would first be released directly from dump scows, and then suitable material would be placed over the unsuitable material by submerged pipelines. For unconfined disposal, suitable material would be released directly from dump scows. (In this section, "suitable material" means material suitable for unconfined aquatic disposal, and "unsuitable material" means material unsuitable for unconfined aquatic disposal.)

An underwater dike would be constructed to hold the dredged sediments in place. The dike itself would be 13.5 feet tall but, since it would be placed in water that is 31 feet deep, it would have an effective elevation of -17.5 feet MLLW. The dike would have 6:1 side slopes (i.e., a 6-foot horizontal change to every 1 foot vertical change). The area of the diked pit would be approximately 404 acres. The preliminary placement design for disposal at this site indicates that 4.3 feet of unsuitable material would be capped by 5.7 feet of suitable material. This dike design could contain 2.88 mcy of unsuitable material and 3.60 mcy of clean material, for a total of 6.48 mcy. The top of the clean material would be at an elevation of -21.7 feet MLLW (i.e., the water overlying the capped sediments would be 21.7 feet deep). A conceptual design for the cap is shown in Figure 2.7.3-2. The cap is expected to contain

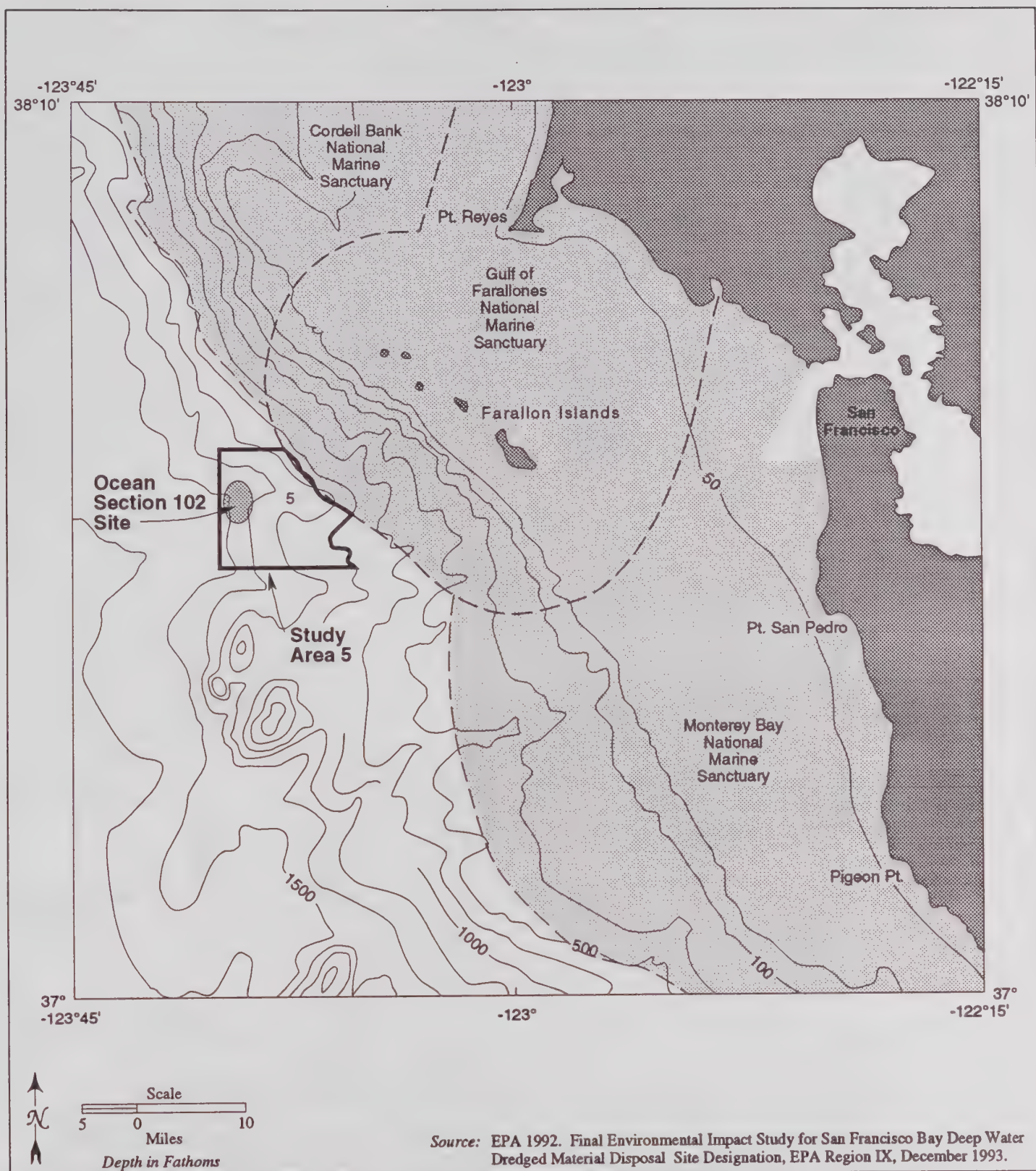
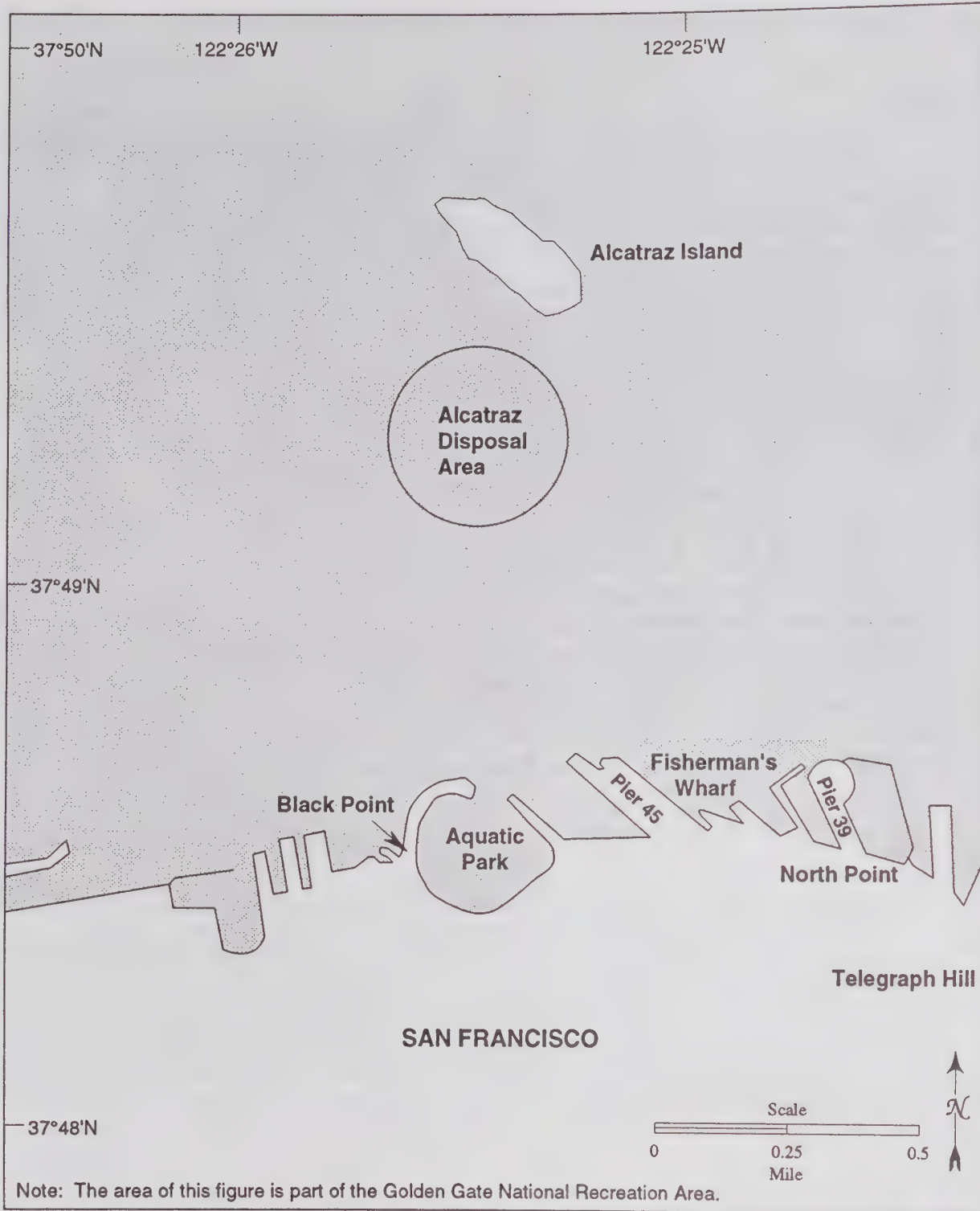


Figure 2.7.1-1

OCEAN SECTION 102 SITE (ALTERNATIVE SITE 5 IN THE LTMS STUDY REGION)



Source: COE 1992. Appendix D - Finding of No Significant Impact (FONSI) and Environmental Assessment, Oakland Inner Harbor 38-Foot Separable Element of the Oakland Harbor Navigation Improvement Project, June.

Figure 2.7.2-1
ALCATRAZ DISPOSAL AREA

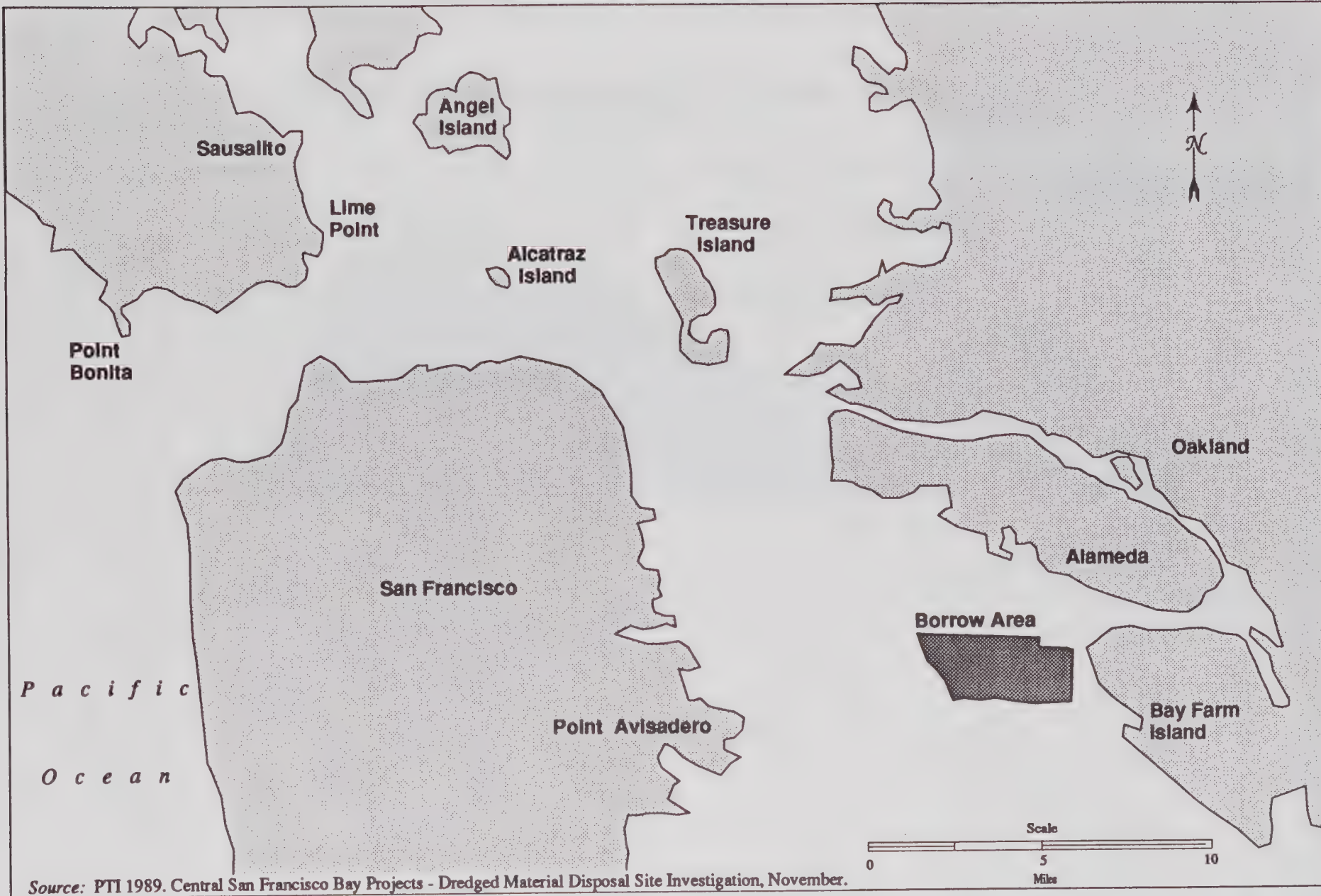
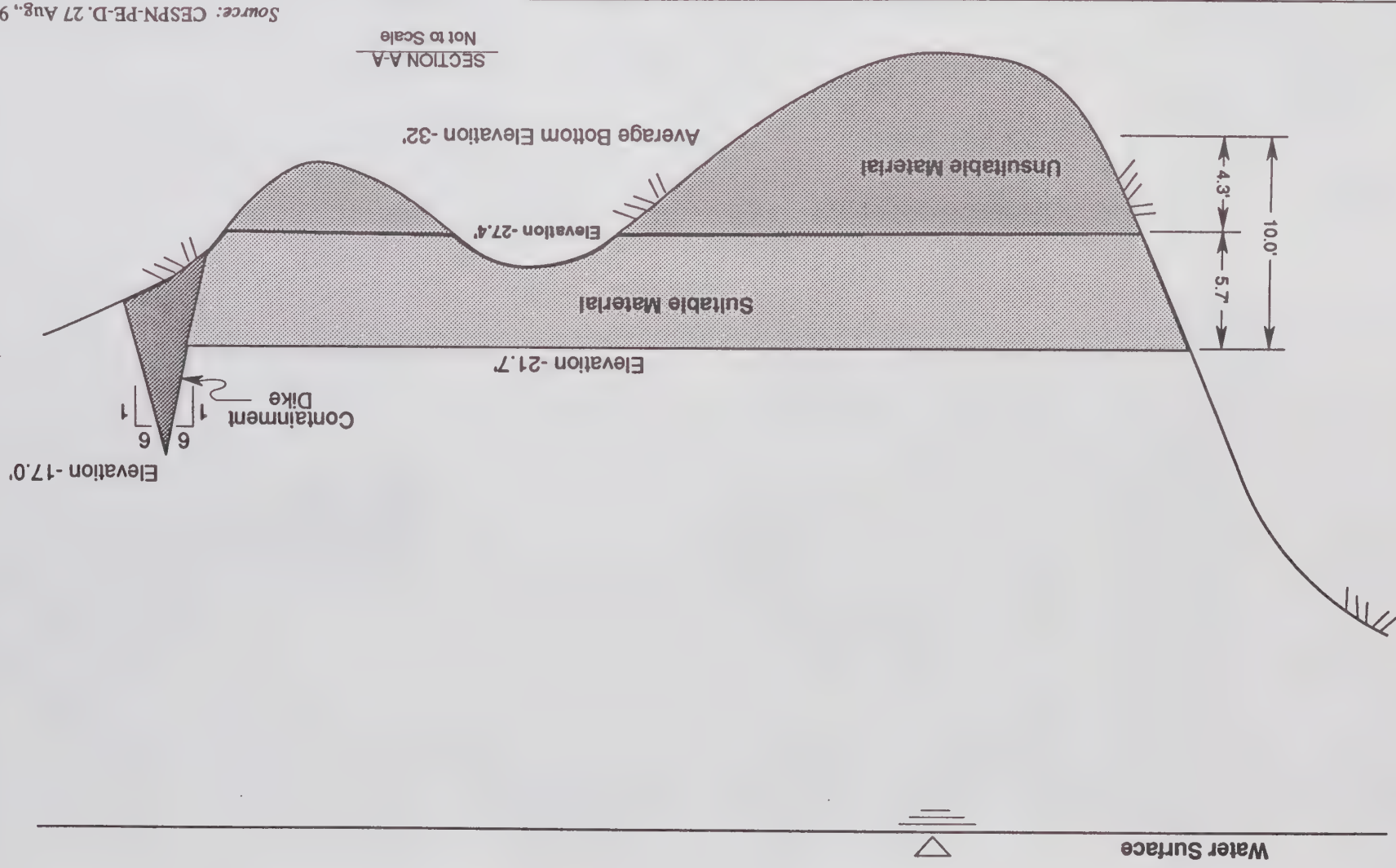


Figure 2.7.3-1

BAY FARM BORROW AREA

Figure 2.7.3-2
CONCEPTUAL CAPPING PLAN FOR THE BAY FARM BORROW AREA (PLAN B)

2-30



Source: CESPN-PE-D. 27 Aug., 93

all the unsuitable sediments, and the life of the cap is expected to be indefinite through implementation of a site management and monitoring plan that would continue indefinitely.

The following capping scenario is based on telephone conversations with the Corps (personal communication, D. Hancock 1993). To minimize prolonged exposure of unsuitable material deposited at the BFBA, the unsuitable material would be covered (capped) periodically (approximately every 30 days) with suitable material. The diked area of the borrow pit would also be divided into "cells," each of which would be filled and capped separately, which also would limit the area of exposed unsuitable material. The cell walls would be built of suitable material, probably at a 6:1 slope. Since unsuitable material would be capped every 30 days, the cells would be sized to contain a 30-day supply of unsuitable sediments. The initial cap on each cell would be relatively thin; a final, thicker cap would be placed over the entire disposal area when disposal at this site was completed. SAIC assumes that the initial thin cap, assumed to be thick enough to isolate unsuitable material from the biological zone for about 2 years, would be about 30 centimeters (roughly 1 foot) thick.

The Corps estimates that 150,000 cy of unsuitable material could be dredged in a 30-day period. Assuming a depth of 4.3 feet for the unsuitable layer, the area of each cell would be 942,000 square feet, or 21.6 acres. Since the site is 404 acres, there could be 18.7 cells or, rounding up, 20 cells. The 20 cells would be laid out in a rectangular grid, with 4 cells running north-to-south and 5 cells running east-to-west. The amount of clean material needed to construct the cells walls would have a negligible effect on cap thickness.

2.7.4 Leonard Ranch/Redwood Landfill

This disposal option could be used for disposal of 0.2 to 1.2 mcy of sediments that are unsuitable for ocean disposal. The sediments would be dried over approximately 188 acres of the 230-acre Leonard Ranch site, and then hauled by truck to Redwood Landfill approximately 12 miles away by road in Marin County for use as either daily cover or construction material (see figures 2.7.4-1 and 2.7.4-2).

Under this option, sediments would be dredged from the Oakland harbor by either a clamshell dredge or hydraulic cutterhead dredge and loaded onto 3,000 - 4,000 cy capacity barges. Filled barges would be towed approximately 16 miles to the unloading point in the vicinity of the Petaluma River Channel entrance. The dredged material would then be pumped through a floating pipeline as a slurry onto land, using a modified hydraulic dredge to the Leonard Ranch site. Once on land, the pipeline would follow a route along an area of existing upland vegetation, then continue along an existing access road, and then finally cross beneath the Northwestern Pacific railroad track through an existing culvert to reach the Leonard Ranch site. The material slurry would be about 15-20 percent solids. All waterborne off-loading equipment would be moored on spuds. (A spud is an extendible pile mounted on the side of a dredge or barge which can be driven into bottom sediments under its own weight to anchor the dredged or barge into position.) Dredging and disposal is estimated to last for up to 9 months, depending upon the volume of material disposed at this site.

The Leonard Ranch was recently purchased by the Sonoma Land Trust with funding from the California Coastal Conservancy. It is likely that the Leonard Ranch rehandling facility would be operated by a Joint Powers Agency (JPA) created to operate the facility as a regional rehandling facility for dredged material from multiple projects over a period of 10 to 30 years. The Oakland sediments would be the first sediments to be dried on the site.



Figure 2.7.4-1

LEONARD RANCH AND REDWOOD LANDFILL VICINITY MAP

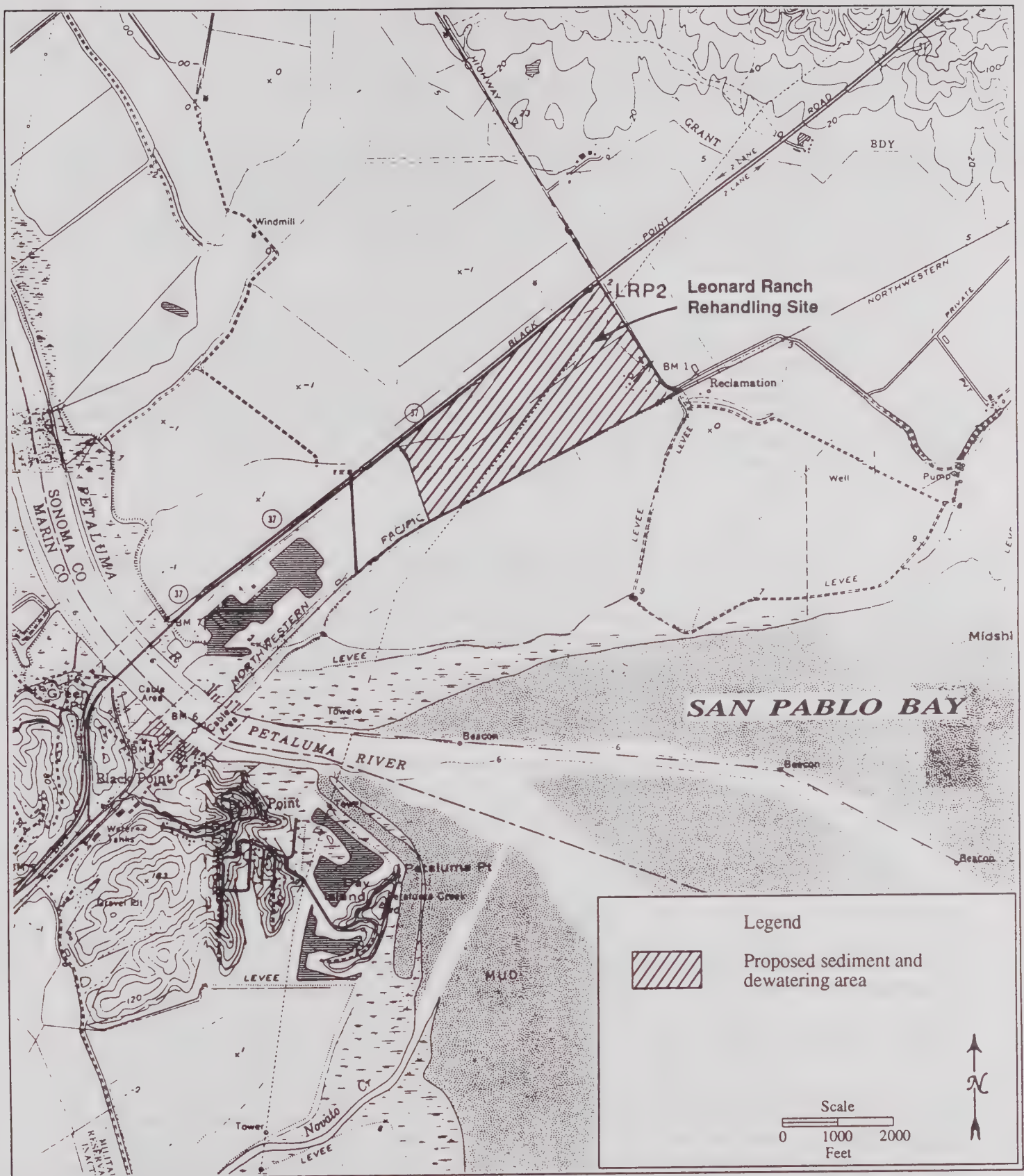


Figure 2.7.4-2

LEONARD RANCH REHANDLING SITE

Proposed Action and Alternatives

Levees would be constructed on the rehandling site to contain the dredged material as it dries. The levees would be approximately 7.5 NGVD feet high with 3:1 side slopes. An interior dike would be constructed to provide access to the existing Pacific Gas & Electric (PG&E) towers that traverse the site. The levees would be constructed with on-site materials. Construction of the rehandling facility is estimated to take 3 months. The western 42 acres of the property, which presently support some seasonal wetlands, would not be affected by the proposed project.

Water decanted from the drying basin would be discharged over a weir into a separate effluent control basin. From this basin, the discharge water would be directed through a culvert beneath the railroad bed into the existing drainage channel, and eventually into the Bay. The effluent control basin would be designed to allow sufficient settling (and treatment, if required) to meet State water quality standards. The dredged material would be moved from the site to Redwood Landfill in stages as it dries. Depending upon the volume of sediments, climatic conditions, and the degree of material handling, all the dredged material would be expected to dry within 2 to 4 years of disposal.

2.7.5 Sonoma Baylands

This option would use up to 2.5 mcy of the dredged sediment to restore tidal wetlands over 289 acres of a 348-acre site in southern Sonoma County (Figure 2.7.5-1). Information concerning the alternative is derived from COE (1994). This site would be used for dredged sediments that meet the RWQCB's (1992) requirements for wetland creation and that are also suitable for ocean disposal. The property is diked, subsided, former tidal wetlands, which is presently used for agriculture and supports some seasonal wetlands. The property was recently purchased by the Sonoma Land Trust, with funding from the California Coastal Conservancy.

The implementation of the Sonoma Baylands project was authorized by Congress under Section 106 of the Water Resources Development Act (WRDA) of 1992. Under this Act, the Corps was directed to use "... dredged material suitable for aquatic disposal to restore, protect, and expand the Sonoma Baylands for the purposes of preserving waterfowl, fish, and other wetland dependent species of plants and animals and to provide flood control, water quality improvement, and sedimentation control." Additional purposes specified in the WRDA are to restore tidal wetlands, provide habitat for endangered species, expand the feeding and nesting areas for waterfowl along the Pacific flyway, and demonstrate the use of suitable dredged material as a resource, facilitating the completion of San Francisco Bay Area dredging projects in an environmentally sound manner. The Congressionally authorized project requires a 25 percent non-federal cost-share for construction, monitoring, and any necessary remediation. The non-federal sponsor (in this case, the State of California) would also be responsible for operation and maintenance of the completed project. It is anticipated that the California Department of Fish and Game will assume responsibility for long-term management of the site. The purpose of the evaluation in this SEIR/S is to address the implementation of the Sonoma Baylands project using sediments from the Oakland harbor deepening project. In addition to evaluation in this SEIR/S, preparation of the Sonoma Baylands site for wetlands restoration with or without dredged sediments independent the Oakland Harbor project has also been evaluated in a Negative Declaration prepared by the California Coastal Conservancy pursuant to CEQA (Conservancy 1991b) and is being evaluated by the Corps pursuant to NEPA (COE 1994).

Site preparation is estimated to take 5 months. A new perimeter levee on the west, north, and east sides of the property would be constructed to protect adjoining properties and the adjacent railroad from



Figure 2.7.5-1

SONOMA BAYLANDS TIDAL MARSH RESTORATION SITE

flooding. A series of interior peninsulas would be constructed to (1) enhance the sedimentation rate on the site by reducing the wind fetch, and (2) protect the interior slopes of the perimeter levee from wave erosion (Figure 2.7.5-2). The top of the levee would be constructed to 8 feet above NGVD (refers to 1929 National Geodetic Vertical Datum) after settlement (Figure 2.7.5-3). Levee construction would require about 700,000 cy of material that would be excavated on-site. The levee would be constructed approximately 100 feet inboard of the existing drainage ditch at the edge of the property. The California Coastal Conservancy is also proposing that the approximately 24-acre area between the new levee and the ditch be converted to seasonal wetland by construction of a small berm to retain local precipitation, and compaction of the underlying soil (Figure 2.7.5-3). This 24-acre seasonal wetland proposal by the Conservancy is not considered mitigation of other impacts.

Under this option, it is assumed that sediments would be dredged from the Oakland Harbor by either a clamshell dredge or hydraulic cutterhead dredge and loaded onto 3,000 - 4,000 cy capacity barges. Filled barges would be towed approximately 16 miles to the unloading point in the vicinity of the Petaluma River Channel entrance. The dredged material would then be pumped to the Sonoma Baylands site as a slurry through a floating pipeline using a modified hydraulic dredge. Once on land, the pipeline would follow a route along an area of existing upland vegetation. The material slurry would be 15-20 percent solids. All waterborne off-loading equipment would be moored on spuds. Dredging and disposal is estimated to last for up to 21 months. The dredged material would be placed hydraulically so that the surface elevation of the site, prior to opening to tidal flushing, would be about +2.0 feet above NGVD, which is below the elevation normally occupied by tidal marshes (Figure 2.7.5-3). Natural sedimentation would be expected to continue to raise the surface elevation, and a tidal marsh would be expected to develop within approximately 10 years, when suitable elevations exist. The use of dredged material is proposed to accelerate tidal marsh development. Without placement of dredged material, the site would require up to 50 years to develop as a tidal marsh, compared to 10 years with dredged material (Figure 2.7.5-4).

Releases of decanted water from the dredged material slurry would be controlled by spillways at three locations in the existing outboard levee. Discharges through the spillways would be monitored to ensure that sufficient retention time occurs for fine-grained particulates to settle out. Discharges during construction would be controlled to meet State water quality standards. To guard against exposing the dredged material to the air and causing oxidation and acidification, the material would never be dried out. A layer of water would cover the material until the tide is introduced to the site. Approximately six months following the placement and consolidation of the dredged materials, the southern perimeter levee would be breached at two locations to initiate tidal circulation. In response to the California Department of Fish and Game's recommendation, the Corps would grade the southern perimeter levee to 4.0 feet NGVD to eliminate red fox denning habitat. The excavated material would be spread along the landward side of the levee.

2.7.6 Galbraith Golf Course

The Galbraith Golf Course would be used for disposal of sediments that are classified as suitable for upland disposal. This site is shown in Figure 2.7.6-1. Up to 1.2 mcy of sediment could be disposed of at this site, depending on the disposal alternative selected. The description of this site and how disposal would occur is based on Gin (1993). This site originally consisted of shallow tidal mud flats, marsh, and uplands adjacent to the Bay. The southwestern portion of the site was filled with municipal garbage. The remainder of the site received some hydraulic fill, overlain by more municipal garbage and

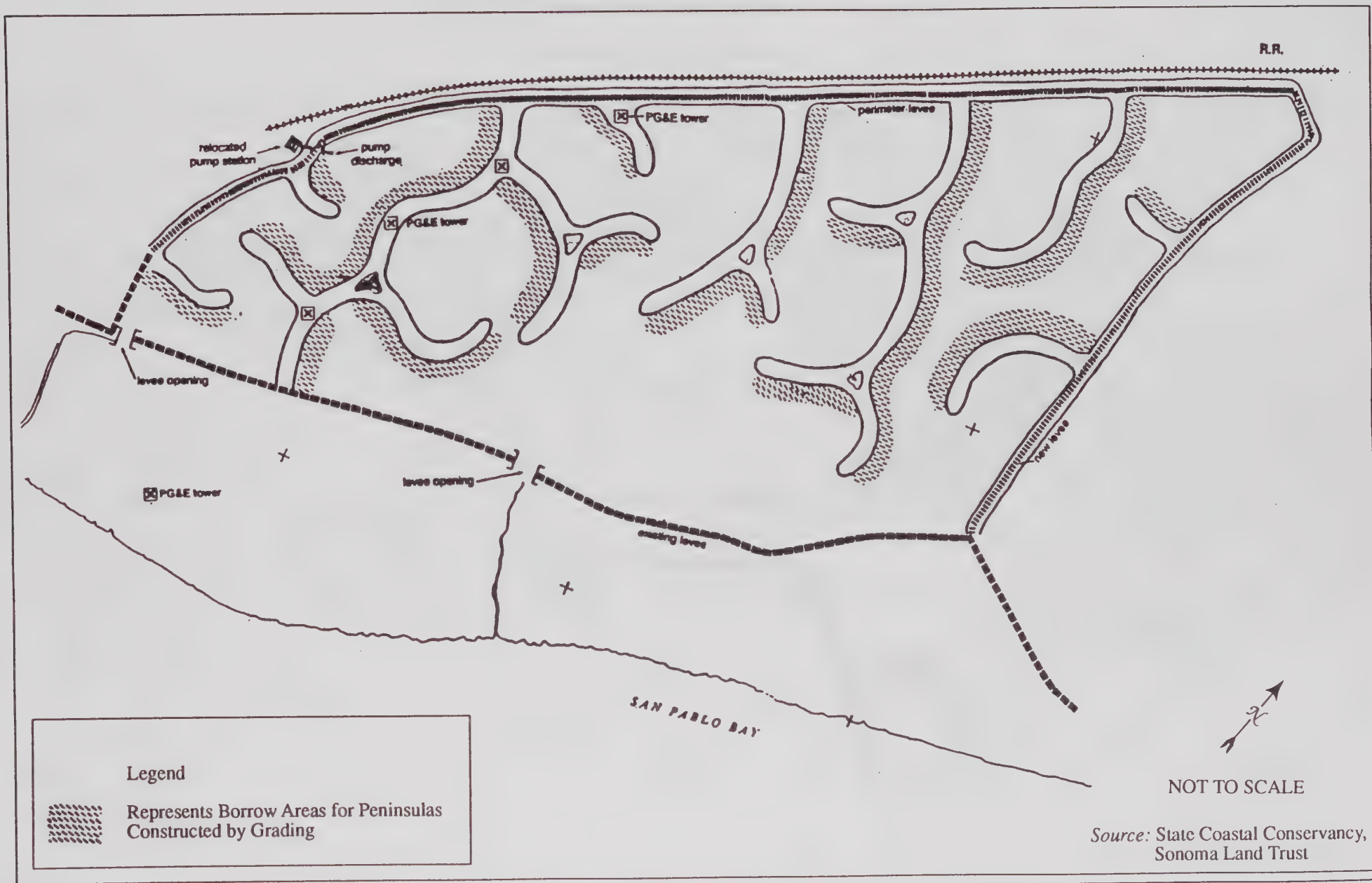


Figure 2.7.5-2

SONOMA BAYLANDS TIDAL MARSH RESTORATION SITE -
INITIAL GRADING

Source: State Coastal Conservancy,
Sonoma Land Trust

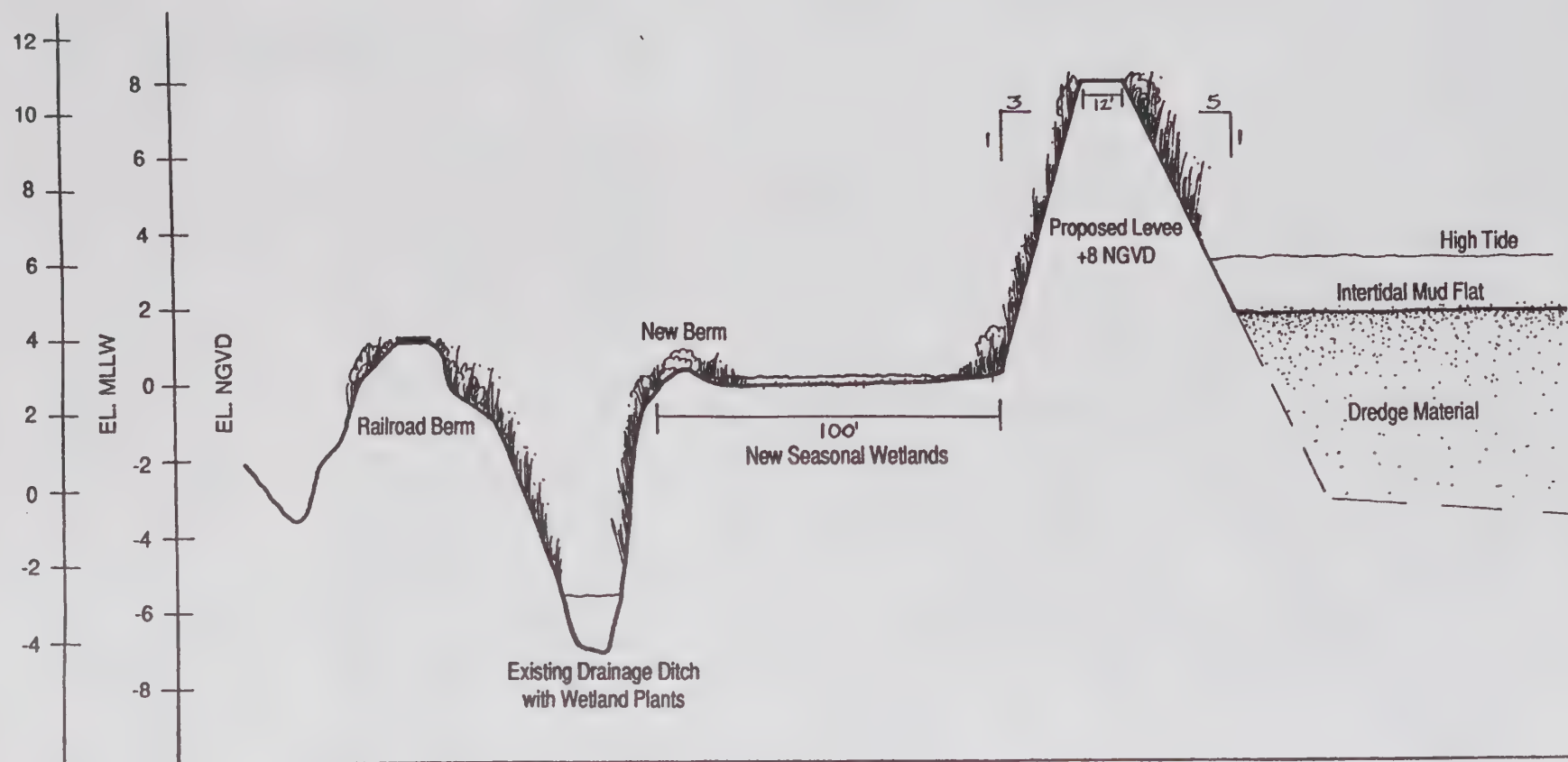


Figure 2.7.5-3

SONOMA BAYLANDS TIDAL MARSH RESTORATION SITE-
TYPICAL LEVEE SECTION

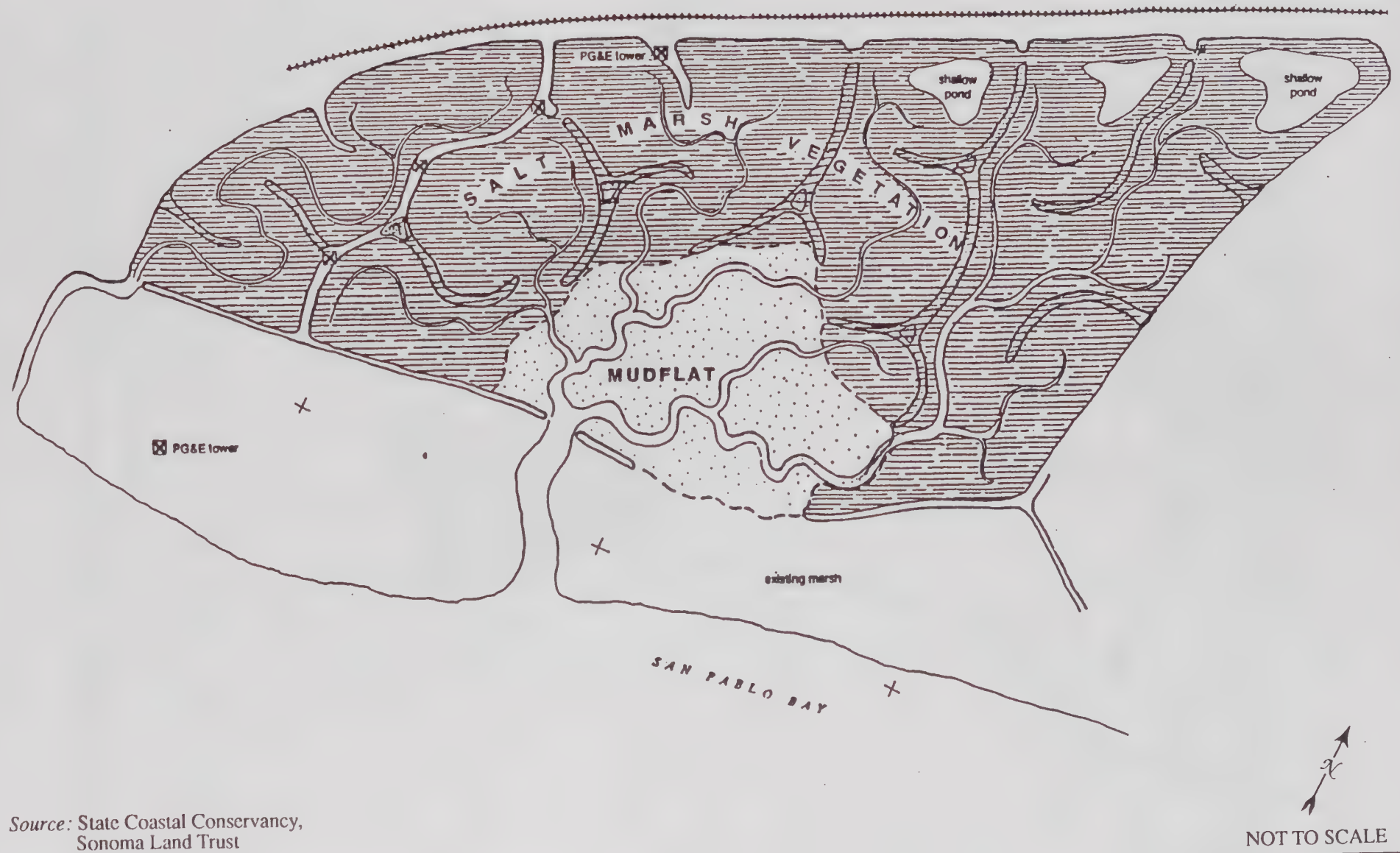


Figure 2.7.5-4

SONOMA BAYLANDS TIDAL MARSH RESTORATION SITE - AFTER 10 YEARS



Figure 2.7.6-1

PROPOSED DREDGED MATERIAL DISPOSAL AREA AT GALBRAITH GOLF COURSE

demolition debris. Beginning in about 1965, the garbage and debris fills were graded to a relatively level configuration and blanketed with a thin layer of clayey soil and a golf course was constructed on top of the fill. Various types of soil and concrete/asphalt and brick rubble fills were reportedly used to construct many of the golf course landscape mounds. Currently, the site is underlain by Bay mud ranging in thickness from less than 1 foot at the northern edge (near Doolittle Drive) to more than 10 feet at the southern boundary.

A portion of the existing golf course would be cleared of all structures, utilities, landscaping, etc. A portion of the surface drainage channel that currently runs down the center of the site will be culverted. Dikes would then be constructed around the cleared portion of the golf course, and the dredged material would be pumped into the dike-enclosed areas (Figure 2.7.6-2). The dredged material would be mixed into a slurry and pumped, either from San Leandro Bay via the Airport Channel (Option A) or from a location in the San Francisco Bay southwest of the golf course (Option B). Under Option B, dredged sediment could be transported by barge via either the Bay Farm Borrow Area or a deep water area in the Bay south of the borrow area (Figure 2.7.6-3). There would be a large pump at the offloading station, with additional booster pumps along the pipeline route to this site. Weirs (a device used to control the flow of water in an open channel) would be used to decant (i.e., draw off) the surface water from the top of the dredge slurry as the dredged material settles and consolidates. The decanted water would be retained behind the weir(s) and treated, if required, to meet State water quality standards before discharge into the remaining portion of the central drainage channel. After the removal of all surface water, a crust management program would be implemented to speed the drying of the deposited material, as described in section 2.7.6.3. When the material is completely dry, the dikes would be lowered and the site regraded for the construction of a new golf course. Use of this site for this sediment dewatering process could make the golf course unavailable for use for a period of 5 to 7 years. As noted above, the dredged sediment destined for this site could be transported from either San Leandro Bay (Option A) or San Francisco Bay (Option B), as described below.

2.7.6.1 Option A – Pump Out from San Leandro Bay

Material dredged from Oakland Harbor that is unsuitable for unconfined aquatic disposal would be transported down the Inner Harbor using 3,000-cy dump scows (their effective capacity is assumed to be 2,400 cy) (Figure 2.7.6-3). The tugs and scows would cross under four bascule bridges with a controlling height of approximately 18.4 feet above Port Datum (15.2 feet above mean sea level). Regardless of whether Option A or B were implemented, three scows would be used, with an empty scow being traded for a full one at the dredging site, and a full scow being traded for an empty one at the off-loading site. This could require one towing tug for transport of the scows and one tending tug at the dredger. The scows would be unloaded using a modified suction dredge (16-inch or 20-inch) stationed as far down the tidal canal as the water depth would allow. The unloader would be secured in place using either spuds or a drop anchor. The dredged material would be mixed with water from San Leandro Bay, and pumped through a submerged pipeline down Airport channel to the channel's terminus. It would then be pumped through an at-grade (i.e., ground-level) pipeline to the golf course. This would require four road crossings (Doolittle Drive, Swan Way, Airport Road, and Airport Access Road). The crossing at Doolittle Drive would require jacking and boring under the roadway; the other three roadway crossings could be trenched. Because of the distance from the unloader to the golf course, a single booster pump might be required along the pipeline, probably near the golf course.

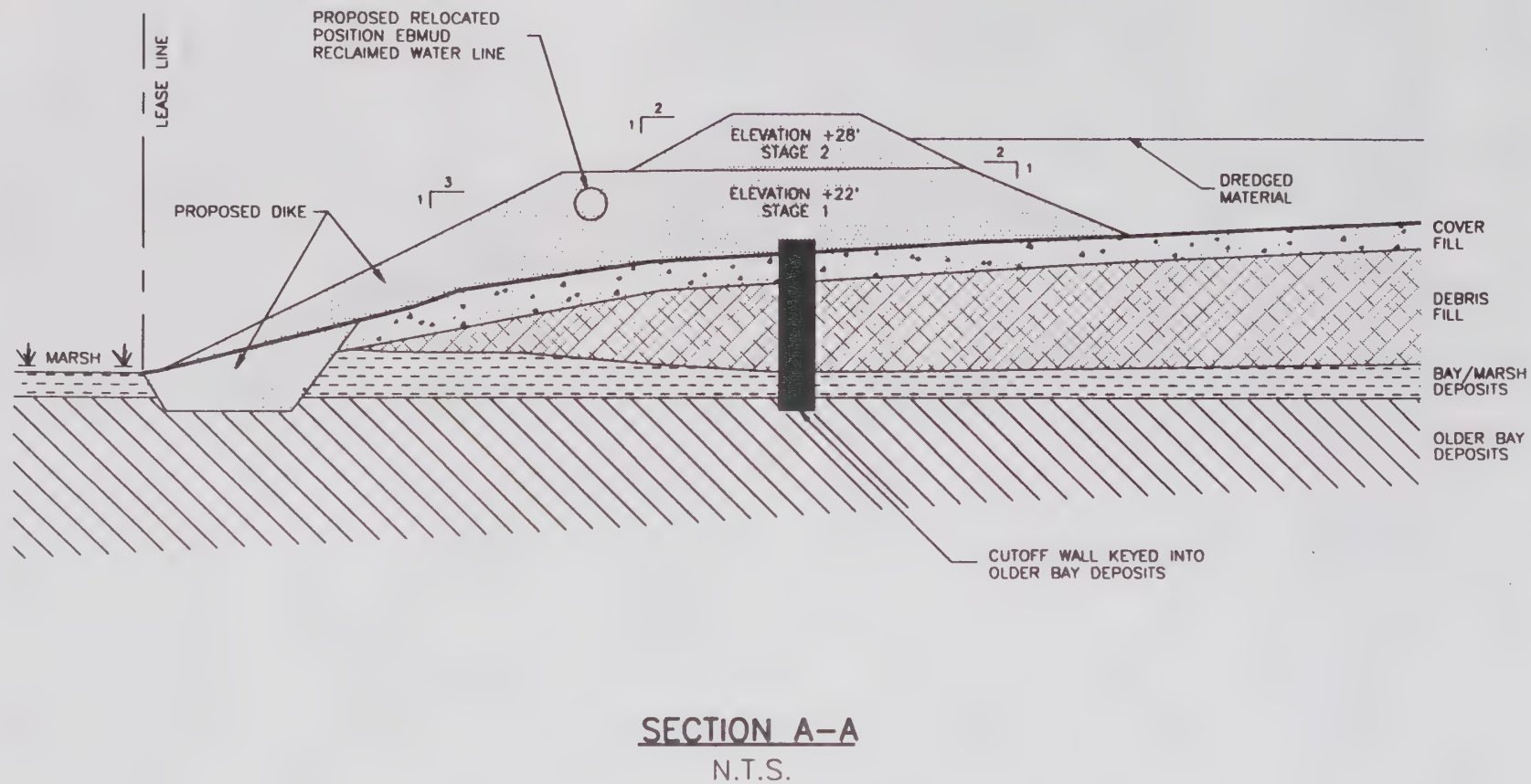


Figure 2.7.6-2
TYPICAL GALBRAITH DIKE SECTION

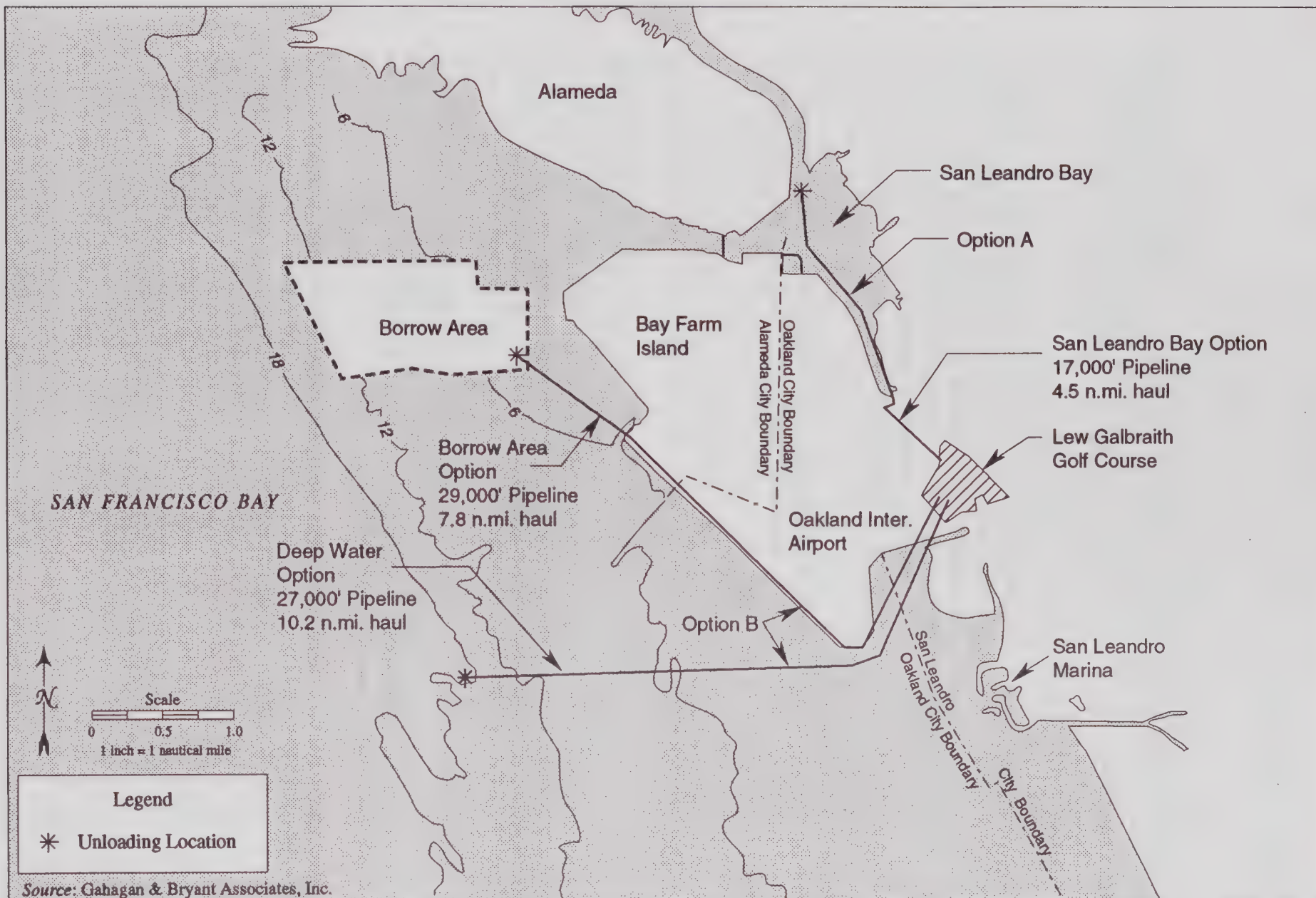


Figure 2.7.6-3

PUMP-OUT AND PIPELINE LOCATION OPTIONS FOR DISPOSAL AT THE GALBRAITH GOLF COURSE

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The submerged portion of the pipeline would be placed closer to the northern bank of the airport channel. The pipeline would be marked and secured to minimize conflicts with recreational use of San Leandro Bay. The unloading station and booster pump would be insulated to reduce the volume of noise during pumping operations. Any needed pumps would be placed at least 500 feet from Arrowhead Marsh.

2.7.6.2 Option B – Pump Out from San Francisco Bay

Under Option B dredged material would be transported to a hydraulic unloader stationed in San Francisco Bay, west of the Oakland Airport (Figure 2.7.6-3). The dredge slurry would then be pumped through a submerged pipeline to the airport dike. It would then be pumped through an at-grade pipeline along the dike to the golf course. Because of the distance from the unloader to the golf course, one or two booster pumps might be installed along the pipeline, probably on the airport dike and/or at the golf course. The unloading station would be located as close to shore as the water depth would permit in order to minimize the length of the pipeline.

As in Option A, the pipeline would be secured and marked. However, the open water location of the in-Bay loader would likely be a greater risk to exposure during inclement weather. Also, because of the limited depth of the Bay west of the airport, the unloader would be stationed near (but within) the Oakland city border.

2.7.6.3 Sediment Deposition

Because the site is underlain by Bay mud, some settlement of the site would be likely due to the weight of the dikes and dredged material. The site is likely to settle about 2 to 4 feet under the dikes and 1 to 3 feet under the dredged material. Primary settlement would occur within 18 months of dredged material placement. To compensate for this, the dikes would be constructed to a crest elevation 1 to 2 feet above the planned long-term crest elevation. Stability considerations would limit the crest elevation to +28 feet MLLW.

An approximately 100-acre drying pond would be constructed on the site (Figure 2.7.6-1). The pond would be surrounded by dikes with 10 to 15-foot-wide crests, about 20 feet high (Figure 2.7.6-2). The dikes themselves would occupy approximately 30 additional acres. The potential capacity of the site would be approximately 1.3 mcy of dredged material.

The dikes would be constructed from material that would be trucked onto the site, with the possible limited use of some of the material comprising the golf course landscaping mounds. Potential sources of material include: Berth 30 excavation material currently stockpiled at various locations within the Port area; material from the Leona Quarry in the Oakland foothills; or certified clean material that would be provided by the construction contractor. Approximately 228,000 cy of material would be necessary for construction of the dike. Some small isolated wetlands on the Galbraith site would be filled with the proposed project. It has been proposed that a portion of the existing drainage channel in the middle of the site, which is also regulated by the Corps under the Clean Water Act, would be culverted. It has also been proposed that the loss of these wetland areas and waters would be mitigated by the expansion of existing wetlands in the northern portion of the site and creation of expanded seasonal wetlands parallel to Airport Drive (Figure 2.7.6-1).

After all surface decant water had been removed, a crust management program would be implemented to speed the drying process. A crust management program would involve working the material, first with a drag line (an excavator equipped with a crane boom) operated from the top of the containment dike, then with lightweight earthworking equipment, to expose the deeper, wet material to the desiccating (i.e., drying) action of the sun and wind. Initially, the material would be too deep and "soupy" to take any equipment out into the cells. Consequently, the first step in the management program would be to dig perimeter trenches with a drag line operated from the crest of the dike. The trenches would facilitate draining additional free water from the material, accelerating the natural drying process. Once the material was dried enough to take lightweight earthworking equipment (e.g., a lightweight "mudcat" equipped with balloon tires) on the site without having the equipment sink into the mud, the relatively dry surface crust would be scraped and trenched in order to further expose the underlying wet material to the sun and wind. The frequency of this operation would depend on atmospheric conditions (temperature, humidity, wind). During the typically dry and windy early fall, the material could be worked once a week (a day to a day-and-a-half per cell); whereas during the rainy season, the material might not be worked even once a month. Care would be taken during the rainy season to grade the site to prevent or minimize rainwater retention and possible erosion of the material. Subsurface drainage wicks could also be used to speed the drying process.

The Port has agreed to construct a new public golf course on top of the dredged material, once dry. The new course will be leased on a long-term basis (66 years) to the City of Oakland. Topsoil will be imported to construct the surface of the new golf course.

2.7.7 Port/Landfill

If the RWQCB determines that any of the sediment to be dredged requires confinement in a commercial sanitary landfill, the Port/Landfill option would be implemented. If landfill disposal is not required, sediments would be disposed at any of the other upland disposal sites in accordance with RWQCB requirements. The dredged sediments would first be placed at the Ninth Avenue Marine Terminal in the Port of Oakland (figures 2.7.7-1 and 2.7.7-2). The sediments would be dried here. The dewatered sediments would then be transported by truck or possibly rail to one of three potential landfills for final disposal. The three landfills are West Contra Costa Landfill (Class III) in Richmond (Figure 2.7.7-3), Vasco Road Sanitary Landfill (Class III) in Livermore (Figure 2.7.7-4), and the East Carbon Development Corporation landfill (Class II) in Carbon County, Utah (Figure 2.7.7-5).

Under this option, any material determined by the RWQCB to require landfill disposal would be dried on a portion of the Ninth Avenue Terminal prior to transport to a landfill site for confined disposal or possible use as daily cover. Disposal at this site would require two clamshell dredges, two tugs, and three dump scows. Sediments would be released at this site by a clamshell dredge. The sediment would be dewatered in batches or cycles. Assuming that a clamshell dredge brings up sediments that are 50 percent solid, it would take two to three months to dry each batch of sediment. The dredged material would be dried in cycles, requiring from two to three months of disposal and drying time for each cycle of about 29,000 cubic yards. Assuming three drying cycles are required, the temporary use of the site as a rehandling facility would thus be about nine months, exclusive of site preparation time.

Two options are currently being evaluated for the construction of the Ninth Avenue upland rehandling facility. Option 1 consists of using a tube made of geotextiles filled with dredged material to create a 4-foot-high berm around the site. Option 2 consists of constructing the berm out of modified K-rail (3 feet

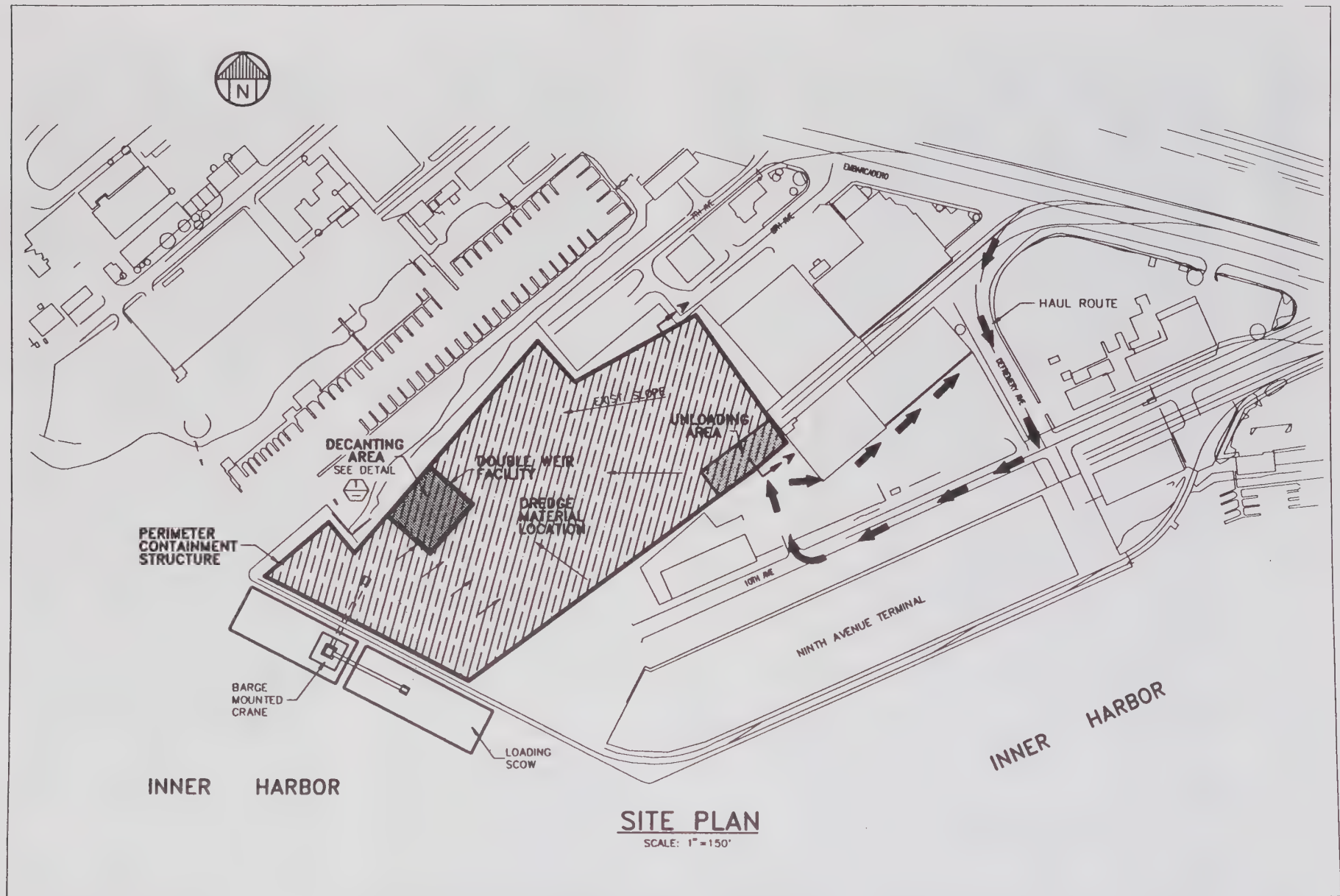


Figure 2.7.7-1

PROPOSED DREDGED MATERIAL DRYING FACILITY AT NINTH AVENUE MARINE TERMINAL, PORT OF OAKLAND

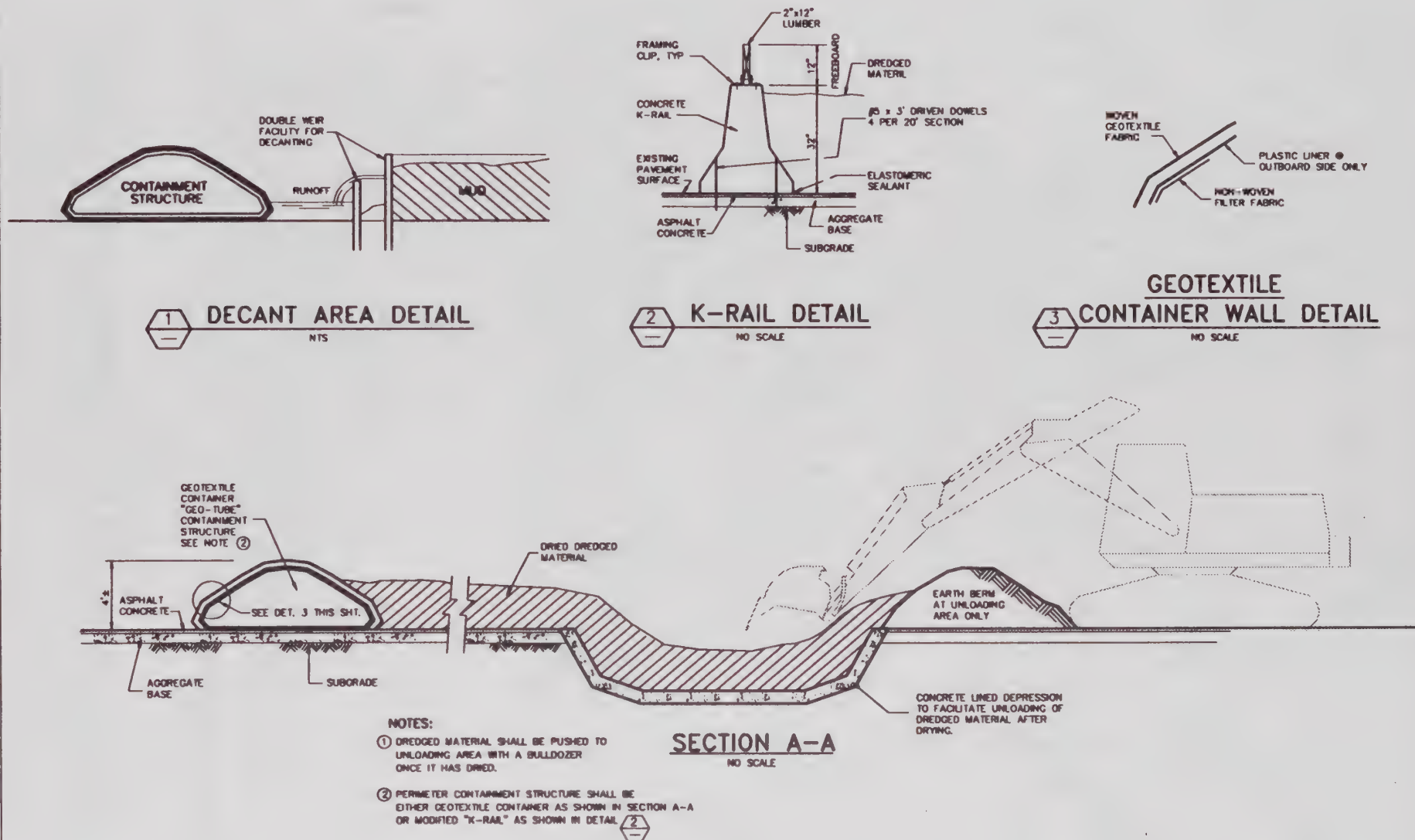


Figure 2.7.7-2

DETAILS OF PROPOSED DRYING FACILITY AT NINTH AVENUE MARINE TERMINAL



Figure 2.7.7-3

SITE LOCATION MAP, WEST CONTRA COSTA SANITARY LANDFILL, CONTRA COSTA COUNTY, CA

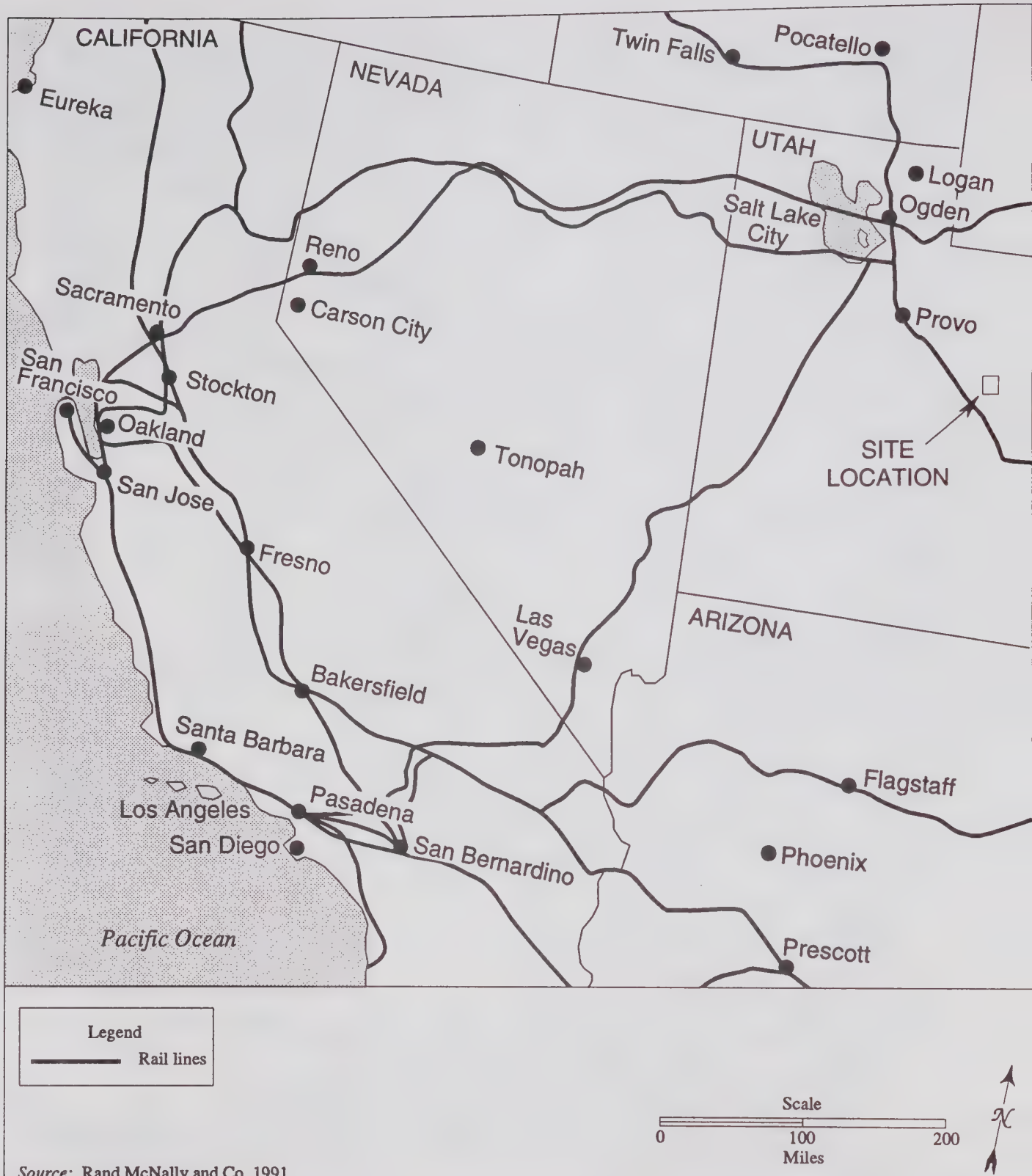


Figure 2.7.7-5
SITE LOCATION MAP, EAST CARBON DEVELOPMENT LANDFILL, CARBON COUNTY, UTAH

high) with 2"x 12" boards attached to the top to increase the freeboard. Site preparation and management will be identical regardless of the construction materials. Final decisions on how the facility will be constructed will depend on which method, or combination of methods, is approved by the RWQCB. If both methods are approved, the final decision will be based on the cost to construct (and remove) the facility and the ease and efficiency of operation. A description of each option follows:

2.7.7.1 Option 1

A perimeter dike will be constructed of two-ply, sealed tubes of geotextile (construction liner) and filled with dredged material. This type of liner has been used in a number of projects throughout the country to contain dredged material. Other projects that have used geotextile tubes to hold dredged materials have included berms, levee, and groin construction projects. The two-ply liners can retain particles as small as clays and silts. Due to electrochemical and physical bonding, clay and silt range sediments contain the majority of the contamination. The geotextile tubes can retain the material and the bound contaminants and allow only the water to pass through. The water discharged from the tubes has the potential to contain low concentrations of dissolved phase contaminants, especially metals. Water extruded from the tubes will be prevented from discharging to the estuary by blocking storm drains and diverting the water into the effluent collection basin. The water will be diverted by inserting impermeable plastic liner between layers of geotextile on the outer half of the tube. The internal liner will divert and retain the water within the bermed area. The water will eventually be discharged to the estuary or treated prior to discharge. Discharge requirements will be established by the RWQCB.

The materials that will be used to fill the tubes will consist of mostly silt and clay range sediments with some minor amounts of sand. Permeability tests on this type of material have shown that it will act as an efficient barrier to both water and sediment placed inside the containment area. Because of the materials' density and permeability, water tends to pool on the surface of the dredged material rather than percolate through the material. Because of the impermeable liner inside the tube and the nature of the material, water will not transport through the berm. In addition, the geotextile tubes will spread and flow at the base, making a wide footprint that can conform to the shape of the surface upon which it is placed. Therefore the filled tubes will act as an efficient seal at the base.

2.7.7.2 Option 2

A perimeter dike will be constructed of reinforced concrete K-rail, approximately 3 feet high, with 2"x 12" timbers attached to the top of the railing, to give a total height of approximately 4 feet. Each rail will be pinned down to the surface with 3-foot long, 5/8-inch steel pins (four per 20-foot K-rail section). Pinning will add more than adequate seismic stability. Joints and corners where the K-rail sections meet will be sealed with mortar with an asphalt sealer as required. To help seal the containment area, the base of the K-rail sections will be sealed using an elastomeric around the entire perimeter. Additionally, impermeable plastic liner will be draped over the railing and attached to the floor of the containment to prevent water or sediment from escaping from joints or seams.

2.7.7.3 Surface Preparation and Site Management

The surface of the drying area will be sealed with a sealing coat of asphalt prior to depositing any material on the surface. The sealing coat will fill any cracks in the surface and decrease the permeability of the surface to a permeability of approximately 10^{-6} cm/sec. To properly remove the sediments from

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the handling area, a pit will be excavated to allow a backhoe to scoop up larger volumes of material from the holding area. The pit will be lined with concrete to a suitable thickness to prevent infiltration. All storm drains will be covered and sealed within the facility. Low weirs will be placed around drains near the facility but outside the confines of the site.

A weir system will be built at the low spot within the containment area. The weirs will be made of wood, K-rail or both with a geotextile screen to further reduce the amount of suspended solids in the effluent. Any suspended particulates will settle out of suspension before passing over the weir. Representative samples will be taken of the water to ensure compliance with the discharge requirements prior to discharging the effluent to the estuary. The RWQCB has determined that a National Pollutant Discharge Elimination System (NPDES) permit will be required for effluent discharge to the estuary. Testing frequency and analysis will be determined by the RWQCB to address the concentration of the constituents of concern. If the discharge needs to continue over a period of days to weeks, the decant will be tested daily for suspended solids and on a regular basis for contaminants of concern. The discharge requirements imposed on the effluent by the RWQCB will be protective of the estuary and "may" be based on background concentrations in the estuary. Depending on the efficiency of the dredging operation and the water content of the deposited material, there may not be effluent from the facility and the water will evaporate on the terminal.

Dredged material will be removed from the dredge material scows by a barge mounted crane and placed into the drying yard. The material in the yard will be distributed within the yard by a tractor. Solids will slowly be worked towards the sediment unloading area, which will be located slightly up-gradient from the decanting area. Because of the density of the sediment, water should be easily separated from the dredge material during handling. The decant water will flow to the decant area while the sediment is pushed towards the unloading area. Decant water will pool behind the first of the weirs until it begins to spill over the top and through the first of the geotextile screens. The geotextile screen will be similar to felt and should retain more than 90 percent of the sediment behind the weir. A second settling area and weir will be constructed on the inside of the first weir. The second settlement area should remove the remaining suspended material from the decant. Initially, the decant that has pooled on the discharge side of the second weir will be tested for permit compliance. It is possible, although unlikely, that there will be a continued discharge from the site over a long term rather than a brief one-time discharge. Decant water discharged over a longer time period will be tested as it is being discharged to the storm sewer system as is allowed by the NPDES permit.

If decant water does not meet RWQCB permit guidelines for discharge, the water can be held and treated in a variety of ways. The exact treatment method will be determined by the contaminants of concern. Organic contaminants may be removed by activated carbon filtration. Metals could be removed through chelation, precipitation, or electrode removal methods. Landfills can typically accept material that contains greater than 50 percent solids and no standing water. Although free water can not be taken to the landfill, sediment with a higher percentage of water than would be optimum based on cost per ton for disposal (but still greater than 50 percent solids) can be sent to the landfill. The final option would be to haul the water to a wastewater treatment facility at a premium price.

Dredged material will be placed in the drying yard to a thickness of approximately 3 feet. One foot of freeboard would be left around the drying yard to prevent surging material from going over the dikes. The material would be left in the facility to dry for up to four months. As previously stated, the landfills can accept soil/sediment with up to 50 percent liquid content. Material dredged using the clamshell

method can generate material with approximately 30 to 80 percent solid content. The cost for hauling and disposing of soil that is 50 percent water is prohibitive and the material is difficult to handle. The material will be left on the terminal to dry until it can be easily handled to minimize disposal cost and not interfere with construction schedules.

A storm water management plan will be developed for this facility. Because of the physical characteristics of the sediment, water will not percolate through the material, but may pool on the surface. This water can be decanted and tested in a similar fashion as the original decant water. As long as the water is decanted promptly, there is little risk of contamination from the dredged sediments. Covering the entire 9-acre site with plastic may be difficult and unnecessary based on the potential risk of contamination. Storm water will not be allowed to discharge directly to a storm drain without testing. If very large storms are expected that could overwhelm the water-holding capacity of the facility, as much of the site will be covered as possible and geotextiles will be used to remove particulates prior to allowing storm water from the facility to enter the estuary.

After drying, the material will be removed by a backhoe and placed into trucks or rail cars and transported to a landfill for disposal.

Use of this site would require the protection of light and power poles. Other at- or below-grade utilities would be surveyed, protected, and marked to avoid damage to them during future excavation of the dried dredged material.

2.7.8 Montezuma Wetlands

The Montezuma Wetlands project is a separate, privately-sponsored proposal (independent of the Oakland Harbor project) currently being considered by the appropriate federal, state, and local agencies. The project sponsor is Levine-Fricke. A draft EIS/S is currently in preparation for this privately-sponsored project. Since the details of the Montezuma Wetlands project are under development, the following Montezuma Wetlands disposal site discussion should be regarded as conceptual. Details of the proposal will be evaluated in depth in a separate EIR/S currently in preparation.

The Montezuma Wetlands site is situated near Collinsville in Suisun Marsh in Solano County (see Figure 2.7.8-1). It is bordered on the south by the Sacramento River, on the west by the Montezuma Slough, on the north by the Potrero Hills, and on the east by the Montezuma Hills. The site is located at the eastern edge of the marsh system about 17 miles southeast of Fairfield. Vehicle access is via State Route 12, Shiloh Road, Birds Landing Road, and Collinsville Road. A total of 6.4 mcy of sediment could be disposed of at this site, 3.2 mcy that would be suitable for cover material and 3.2 mcy that would be unsuitable for cover material. Levine-Fricke proposes to create a tidal wetland at this site by placing a total of approximately 20 mcy of dredged materials, taken from as yet undesignated areas in San Francisco Bay, over approximately 1,800 acres of the 2,000-acre site. An Administrative Draft EIR/S (ADEIR/S) is in preparation for this Montezuma Wetlands Project and site-specific details are currently being developed. The preliminary draft of that document serves as the basis for the following description, the description of the affected environment in Chapter 3, and the impact assessment for this site in Chapter 4 of this SEIR/S. Details of the Montezuma Wetlands project as described here may differ slightly from the EIR/S for that project.

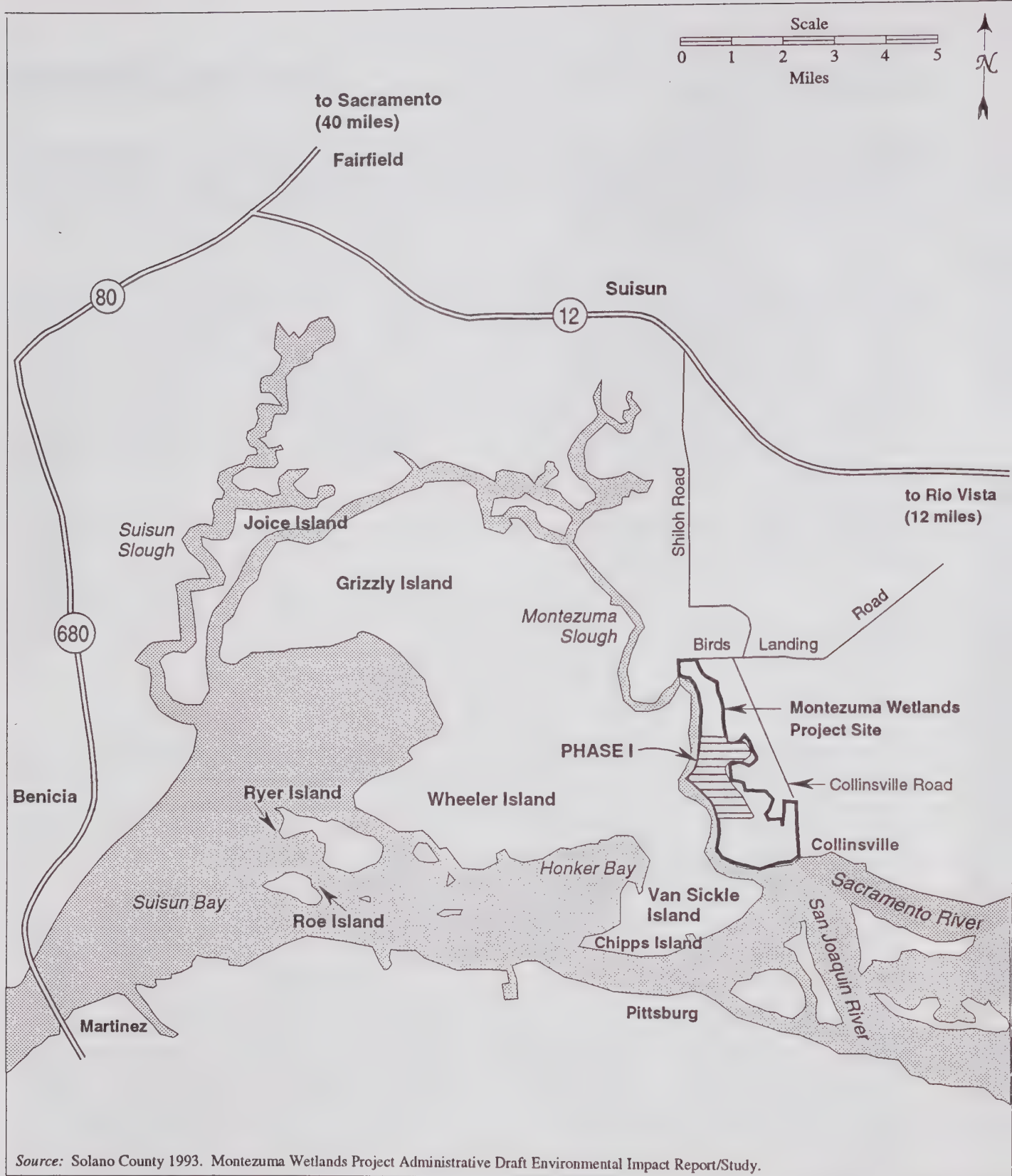


Figure 2.7.8-1
MONTEZUMA WETLANDS SITE

The Montezuma Wetlands Project consists of four phases. There is a specific area of the site associated with each phase, and the phases would be developed sequentially. Oakland Harbor sediment would be deposited only in the Phase I area, which has the capacity of more than 7 mcy. Phase I is intended by the applicant to offset some of the impacts of the subsequent three phases. The four phases are hydrologically independent and semi-autonomous. Each phase would be filled with dredged sediment independently of the other phases. The area of each phase would be composed of smaller sub-units called "cells." Dikes would be constructed to form walls around each cell. Each cell would have a specific design (e.g., for a high or low marsh area). Channels would be constructed to connect the cells. The channels would serve several purposes: drainage from the cells, tidal circulation through the entire area, and migration of aquatic wildlife.

This section describes the construction of the off-loading and rehandling facilities, a subdrain system that would be installed to minimize settling of the existing peat soils that would occur from the weight of the dredged materials, and the sediment disposal operations. The Montezuma Wetlands Project also involves several other project elements that are not described below. These other project elements that would occur during Phase I of the Montezuma Wetlands Project include the following:

- Construction of a tidal marsh;
- Post-construction maintenance and monitoring; and
- Certain public access facilities.

2.7.8.1 Construction

Off-Loading Facilities

It is anticipated that it would take 3 to 4 months to complete the construction of the off-loading facilities. These facilities would be used throughout the life of the sediment placement process. An offloading facility would first be constructed on the south end of the site across from Chain Island. Initially, one or two unloading docks would be constructed on the Sacramento River.

An approximately 130-foot-long by 4-foot-wide pedestrian access ramp would be built from the shore (an existing levee) to a 155-foot-long by 50-foot-wide off-loading barge, which would be moored perpendicular to the shoreline on the Sacramento River. The pedestrian access ramp could be a prefabricated ramp, fixed at the shore on a landing. The other end would be supported on the off-loading barge deck, moving up and down with the tides. The off-loading barge would be anchored in place by two 100-foot-long by 50-foot-wide "working barges" that would also be moored parallel to the shoreline at the extreme riverward end of the off-loading barge. There would be a control room on the offshore end of the off-loading barge. The offloading barge would support the pumping and ancillary equipment. The working barges would support mooring fixtures to accommodate the transport barges in the various positions required to facilitate off-loading. No dredging is anticipated in order to construct the facility. A floating plant with pile driver and crane would mobilize to the site to drive anchor piles. The off-loading barges would then be mobilized to the site, positioned, and secured in place to the anchor piles. Smaller work boats could be used to assist the operation as well as tend anchor lines for the floating plant.

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1 Transport barges (235 feet long by 53 feet wide), which could hold up to 4,000 cy of dredged material,
2 would bring dredged sediment to the site and moor adjacent to the off-loading barges. When the
3 transport barge is docked, facilities would extend about 235 feet from the shoreline into the river.
4

5 Dredged material would be removed from the transport barges using 1,500-hp diesel-powered pumps at
6 the off-loading facility. A suction pipe would be supported over the scows by a mast arm or boom and
7 an A-frame or other type of support system located on the working barge. Prefabricated structural
8 support members would be transported to the site and assembled on the working barge using the floating
9 plant and crew. The suction pipe support structure would be attached to the barge structural framework
10 and rise 72 feet above the deck of the barge.
11

12 A control room would be located near the suction pipe to oversee the off-loading operation. The room
13 would be elevated above the working barge deck so that the operator would be able to view the transport
14 barge as pumping occurs. Prefabricated tower supports for the control room would be transported to the
15 site and erected onto the working barge deck using the same floating plant and crew. A prefabricated
16 control room could be then be placed atop the support structure. The tower would house control
17 equipment for the pumps and mast arm/suction line; the pumps and pipelines would be located on the
18 barge deck, except where the pipeline crosses from the barge to the shore, and a flexible floating line
19 would be used.
20

21 To unload the barge, water would be pumped into the moored transport barge. As the water mixes with
22 sediment, a slurry is created. This slurry would be sucked out of the transport barge through the off-
23 loading suction pipe. An operator in the tower would control the suction pipe.
24

25 The suction pipeline would connect to the transport pipeline at the shoreline. Initially, one off-loading
26 pumpout facility would be built but another facility could be needed. Each pumpout facility needs
27 approximately 500 feet of shoreline because of barge maneuvering. There is 2,000 feet of shoreline
28 available for the mooring and unloading facilities.
29

30 *Sediment Distribution Facilities*

31
32 A 20-inch-diameter, high-density, polyethylene pipeline would be placed between the unloading facility
33 and the proposed marsh creation sites. This primary pipeline would carry dredge material slurry to the
34 marsh sites and would remain in place for all four phases of the project, a period of several years. It
35 would be approximately 17,000 feet long when extended to the Phase I marsh creation project, and would
36 extend another 4,000 feet to a total of 21,000 feet to reach Phase III, the farthest pumping distance.
37 Trench excavation would be required to place the pipeline under Fire Truck Road.
38

39 The primary pipeline would be placed inland of the railroad trestle. The pipeline would be placed on the
40 ground surface where possible. Wooden pipeline supports would support or guide the pipe and allow
41 small mammal passage below the pipeline if necessary. Large concrete blocks, called thrust blocks,
42 would be placed at locations where the pipeline turns abruptly. One would be located 500 feet north of
43 Fire Truck Road. Another would be located 100 feet south of Fire Truck Road. The thrust blocks would
44 require several cubic yards of concrete each and would be several feet long by several feet wide. (Recent
45 communication from Levine-Fricke indicates the site is sufficiently large so that thrust blocks would likely
46 not be needed [personal communication, Stuart Siegel 1994].)
47

Secondary pipelines, which are also 20 inches in diameter, would convey the material from the primary pipeline to the selected placement cells. The secondary pipeline would be placed under the railroad trestle. Secondary pipelines would be removed after each cell is completed, but are likely to be in place for one to four years.

One or two 1,500-hp mobile, diesel-powered booster pumps with anchors would be placed at locations along the primary pipeline to keep the dredge material slurry moving through the pipeline. One pump would be located 3,200 feet north of Fire Truck Road, inland of the railroad trestle. Another would be 1,800 feet south of Fire Truck Road about midway between Collinsville Road and the Montezuma Slough levee.

Access Roads

Two types of road would be used for construction activities and access: primary roads (those used throughout the life of the project) and secondary roads (those to be abandoned on the completion of particular phases). Two existing roads would remain unchanged and serve as primary access. These are Fire Truck Road and Dinkelspiel Road. They would be used for access throughout the life of the project.

New primary roads would be constructed on the levees that are placed between the phases, as well as on the perimeter levee that surrounds the project. The existing road would be abandoned and a new road constructed for primary access adjacent to the McDougal Cut channel. This road would extend between the Jerico Towing facility and the shoreline at the off-loading facility. The road would be about 10 feet wide and elevated above the upland habitat in the vicinity. Expansion of the road, grading, and leveling would be necessary to bring in construction material and equipment.

The location of the secondary access roads has not been identified by the project proponent. Some of the levees between cells would be used as secondary roads.

Ancillary Facilities

Utilities, trailers for a field office, and lab facilities would be needed to support the construction and operation of the marsh enhancement project. During Phase I, a construction trailer and a trailer to house monitoring equipment, each approximately 40 feet long by 12 feet wide, would be placed west of an existing road near the off-loading area at the southeast corner of the site.

Electric power would be supplied to the field office area by an existing 12-kV line. Telephone service would be added and carried on the power poles. The existing 12-kV electric distribution line on wooden poles would be relocated to run parallel to the new access road.

Diesel fuel to power the dredge material slurry pumps and construction equipment would be stored on site. Approximately 4,500 hp would be necessary for pumping dredged material. A 5,000- to 10,000-gallon, above-ground, diesel storage tank would be located in the work area adjacent to the offshore stations to store fuel for the project. Levine-Fricke intends to use a double-walled tank and install a containment berm to reduce potential spills of diesel fuel (personal communication, Stuart Siegel 1994).

Potable water would be supplied by truck to the construction trailer and work areas. Portable toilets would be located at the construction trailer and work areas. Wastewater would be removed by sanitary

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wastewater disposal trucks. At least two portable toilets would also be placed at the site as part of Phase I.

Parking and storage would also be provided. A parking area would be adjacent to the field office and a storage area would be inland of the unloading area. The parking lot would be cleared, graded, and covered with roadbase material. The size of the parking and storage areas has not been specified.

Two boat launch ramps would be constructed. The first ramp would be located on McDougal Cut on the Sacramento River. The second ramp would be constructed at the end of Dinkelspiel Road. Boat access would be used to inspect levees, channel outfalls, and for wetland monitoring.

Rehandling Facility

The project would include a 165-acre rehandling facility to dewater a portion of the dredged materials for use in on-site levee construction. This facility would consist of three containment cells, one settling pond, a water storage sump, and a staging area. The total area of the three containment cells would be approximately 77.8 acres. (The staging area and return water sump, which are also used for the wetlands restoration, would be approximately 7 acres in area.)

A single spillway would drain each cell into the settling pond. The settling pond would be drained either into the return water sump (for reuse on site) or into the Sacramento River through a spillway and flow-control structure.

The existing access road and utilities would be realigned to the outboard levee along the McDougal Cut. The outboard levee would be improved to allow for site personnel and construction traffic. The alignments of interior containment dikes are intended to be relocated according to actual need. The conceptual alignment of the interior dikes would separate the cells into areas of 27, 18, and 32 acres. At 77.8 acres with a 4-foot lift, the site would contain a volume of 0.50 mcy. Assuming a 40-percent bulking factor, the site has an *in situ* dredged sediment capacity of 0.36 mcy. Assuming the material could be dried in one year, the estimated annual throughput would be 0.36 mcy.

2.7.8.2 Subdrain System

Much of the site is underlain by peat soils that would sink when dredged materials are deposited over them, making it difficult to predict final elevations. In an effort to solve this problem, a system of subdrains would be constructed in these areas. These drains are intended to compact the peat soil and increase predictability regarding the final elevations. In addition, the system would provide additional sediment capacity. The subdrains would be set back from the levees. This drain system would remove shallow brackish groundwater from an area prior to placement of dredged material and would be separate from the pond drainage system used to draw excess water from the dredged sediments.

The trenches would be about 5 feet deep and approximately 1 foot wide with a 60- to 100-foot center-to-center spacing. Trench length would vary depending on the size and shape of the area to be drained. Collector trench locations would be chosen to take advantage of anticipated settlement. Initial trench slope would be on the order of 0.5 percent and, by design, slopes should increase as settlement occurs. Individual trench runs would be on the order of 300 to 400 feet.

Modeling results indicate that it would take approximately six months to lower the groundwater level beneath the sediment placement cells at least 2 feet. The anticipated average system flow rate would be approximately 50 to 60 gallons per minute (gpm).

The thickness of peat and organic soils generally increases in the direction of the Montezuma Slough. Consequently, the trench system would be laid out to take advantage of the expected settlement patterns to maintain drainage in the trenches. Given the expected lengths of individual trenches and relatively flat grades at the site, multiple collection trenches and/or discharge points would be required to maintain reasonable trench depths across the site. Trenches would be constructed with the minimum grades necessary to maintain system operation and to maintain reasonable excavation depths.

The subdrain system would be constructed during the pre-operation stages of the project, using a trenching machine. Drain rock, washed gravel, or permeable material would be placed to within 12 inches of the ground surface. A cap of native soil would be placed above the drain material to seal the trenches.

2.7.8.3 Disposal Operation

Disposal at this site would require one clamshell dredge, two tugs, three dump scows, and a pump-out barge. Sediments would be released at this site by pumping out of a barge.

Dredged material would be transported to the site by barges that hold up to 4,000 cy of material each. Barges would bring dredged material to these unloading facilities and moor while this material is being unloaded. The unloading process would take approximately three hours. The dredged sediment would be pumped out through the pipeline to the designated disposal area. Because the material may be too stiff, too dense, or too high in solids for pumping through a pipeline when they reach the site, water would be added to the barges to make a mud and water mixture called slurry.

The maximum rate of acceptance of the dredged material, assuming 24 hours/day off-loading, would be approximately 60,000 cy per day. This rate, however, could never be achieved for any extended period of time, given that the slurry would need time to settle before new slurry could be added into the sediment cells.

Shallow, brackish groundwater would be pumped to create an adequate water supply for making the slurry. In order to get an adequate water supply to create a slurry for eight barges a day (32,000 cy of material initially), approximately 5 million gallons per day (mgd) would be needed. Water could be reused; it is estimated that 2.9 mgd would be needed on a daily basis. And, since groundwater would be recharged by infiltrated water from the water storage ponds, use of "new" groundwater during active pumping could be less than half of this peak estimate. Over a 10-year project life, with pumping occurring about 40 percent of the time, average water use estimates would drop below 1 mgd.

Water for reuse would be stored in holding ponds. The ponds would be constructed to contain a total capacity in excess of 100 million gallons. One storage pond, which would be located immediately south of Fire Truck Road and the Department of Water Resources day use area, would cover 47 acres and have a capacity of 75 million gallons. A second holding pond would be located closer to the Jerico dredging operation, cover 16.5 acres, and have a capacity of 37 million gallons. A channel would be constructed

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from the west holding pond to the east holding pond and then to the sump for the off-loading facility. The channels would be approximately 11,000 feet long and have a capacity of 1.5 million gallons.

Slurry Water Discharge

After the slurry has been pumped through the sediment pipeline and discharged into the cells, the decant water would then be filtered through geotextile fabrics and discharged over a weir or through drains in the levees. The geotextile fabrics would be used to filter out suspended sediment in the decant waters. The discharged water would be monitored by a turbidity meter to test solids concentrations, and routed to the return water channel and the storage ponds. Water from placement operations would be periodically discharged to the Sacramento River at the sump by the off-loading facility. Water would require discharge periodically to maintain acceptable salinity concentrations for placement operations and when excess water is not needed. Water discharge would have to meet State water quality standards. No schedule or criteria for discharge has yet been established.

Operation of the Rehandling Facility

Before operations begin, the site would be cleared and minimally graded. Initially, a permanent lift of approximately 2 feet of sediment would be placed to even out site topography and provide a level base for subsequent sediment placement and scraping.

The proposed rehandling facility would accept only cover material identified by regulatory agencies and end users as suitable for rehandling. The dredged sediment would be off-loaded from scows and pumped through a 20-inch pipeline to one or more of the containment cells. Pumping distances would be between approximately 500 and 2,200 feet, depending on which cell is active. At that point, water would be added as the makeup water to bring the offloading slurry to the desired viscosity. This would have the effect of slightly lowering the salinity in the sediments. Once the dredged sediments have settled within the containment cells, water would be drained to the return water sump and/or settling pond for further clarification. Upon completion of this final clarification, the decant water would be analyzed to meet State water quality standards. The water would then be discharged into the Sacramento River or reused as makeup water.

Once evaporation, infiltration, and handling have dried the sediments, the processed sediments would be stockpiled near on-loading/off-loading facilities with scrapers on an as-needed basis.

Rehandling activities are expected to be conducted throughout the wetlands restoration site preparation, sediment placement, and short-term wetlands establishment phases of the project. At the end of these phases, permanent sediment would be placed in this area to between +5 and +12 NGVD elevation. (NGVD refers to 1929 National Geodetic Vertical Datum).

2.8 CATEGORIES OF DISPOSAL ALTERNATIVES

In addition to the No-Action Alternative (see section 2.3), 12 alternatives were considered. These 12 alternatives are comprised of different combinations of the eight disposal sites described in section 2.7. The alternatives analysis in this SEIR/S focuses on disposal options, not dredging options. Dredging alternatives were addressed in previous environmental documents on Oakland Harbor dredging (see section 1.5). There have been no significant changes related to the dredging alternatives considered in

these previous analyses since those documents were completed that would suggest that additional dredging alternatives be analyzed. The dredging alternatives analysis in these previous documents is, therefore, incorporated by reference into this SEIR/S.

The quantities of sediment that would be disposed of at each site under each alternative are summarized in Table 2.8-1. As shown in this table, the sum of the sediment quantities for all the sites under each alternative totals 6.6 mcy. This is an increase of 800,000 cy over the 5.8 mcy shown in the Draft SEIR/S. The 800,000 cy includes (1) 600,000 cy of required 1 foot of overdepth in those channel and berth areas that contain "hard" material (i.e., Merritt sand and/or Old Bay mud) -- the overdepth dredging in these areas is necessary to ensure that "hard" material high points do not protrude into the authorized -42 foot MLLW channel/berth areas; and (2) 200,000 cy of material throughout the project area attributed to more refined bathymetry and volume calculations. Subsequent to the Draft SEIR/S, the RWQCB determined, in a letter dated May 2, 1994, that sediment originally destined for the Port/Landfill disposal option would be suitable for disposal at Galbraith Golf Course provided that adequate protection is incorporated into that site's design. The Port/Landfill disposal option is thus now considered only under Alternative B1 in Table 2.8-1, although it could be used in conjunction with other alternatives if the RWQCB changed its determination.

The following nine assumptions were developed in formulating these disposal alternatives.

Dredging Assumptions

1. All volume estimates in Table 2.8-1 include dredging to project depth (i.e., -42 feet MLLW), plus a required 1 foot of overdepth in those channel and berth areas that contain "hard" material (i.e., Merritt sand and/or Old Bay mud), plus a 1 foot tolerance overdepth throughout the entire project area. The required 1 foot of overdepth dredging for those channel/berth areas with "hard" material is necessary to ensure a -42 foot project depth. The 1 foot of tolerance overdepth dredging is needed to address the inaccuracies of the dredging process.
2. The estimated total volume to be dredged, including overdepth, is 6.6 mcy.
3. Undisturbed Merritt sand formations are suitable for ocean disposal provided that the mitigation measures listed in section 4.2.6.2 are implemented.
4. In a worst-case analysis, up to 100,000 cy of dredged material may require disposal in a sanitary landfill. The RWQCB has determined that with adequate upland containment measures, no sediments will require landfill disposal (see RWQCB comment letter, Appendix M).

General Disposal Assumptions

5. Elevated chromium values alone did not disqualify sediments for either wetland cover or non-cover because of high natural background levels from geologic inputs into San Francisco Bay and the non-toxic effect of the chromium.

Table 2.8-1. Matrix of Disposal Alternatives¹

<i>Alternative</i>	<i>Ocean</i>	<i>Alcatraz</i>	<i>Borrow Area</i>	<i>Sonoma Baylands</i>	<i>Montezuma Wetlands</i>	<i>Galbraith</i>	<i>Leonard Ranch/ Redwood Landfill</i>	<i>Port/Landfill²</i>	<i>Total Volume</i>
A1. Maximum Ocean Disposal	5.4					1.2			6.6
A2. Maximum Ocean Disposal	5.4						1.2		6.6
B1. Maximum Wetland Restoration	0.1				3.2/3.2			0.1	6.6
B2. Maximum Wetland Restoration	2.9			2.5		1.2			6.6
B3. Maximum Wetland Restoration	2.9			2.5			1.2		6.6
C1. All Upland Disposal					3.2/3.2	0.2			6.6
C2. All Upland Disposal					3.2/3.2		0.2		6.6
D1. Maximum Confined Aquatic Disposal			4.8/1.8						6.6
E1. Maximum In-Bay Unconfined Aquatic Disposal	0.7	4.8				1.2			6.6
E2. Maximum In-Bay Unconfined Aquatic Disposal	0.7		4.8			1.2			6.6
E3. Maximum In-Bay Unconfined Aquatic Disposal	0.7	4.8					1.2		6.6
E4. Maximum In-Bay Unconfined Aquatic Disposal	0.7		4.8				1.2		6.6

- Notes:**
1. All volumes are in million cubic yards. Where two numbers separated by a slash are noted, the first number is the volume suitable for cover material, and the second number is the volume that is unsuitable for cover.
 2. This option would be implemented only if required by the RWQCB; otherwise, this material would be disposed at Galbraith or Leonard Ranch for the appropriate alternatives. A RWQCB letter dated 5/2/94 stated the material is suitable for disposal at Galbraith provided that adequate protection is incorporated into the site design.

Site-Specific Disposal Assumptions

6. Capping at the Bay Farm Borrow Area with clean material would be done periodically, approximately once every 30 days.
7. Leonard Ranch is designed to serve as a regional dredged material rehandling facility for up to 30 years as previously studied by the LTMS.
8. Sediments considered for disposal at Sonoma Baylands include only material that is both acceptable for ocean disposal and acceptable for wetlands cover on the basis of bulk chemistry (excluding chromium).
9. Montezuma Wetlands would require 1 cy of cover material for each 1 cy of non-cover material.

2.8.1 Maximum Ocean Disposal

There are two alternatives that would maximize ocean disposal for material that is suitable for this option; the difference between the two is whether Galbraith or Leonard Ranch would be used for disposal of the material unsuitable for unconfined aquatic disposal.

2.8.1.1 Alternative A1 (Maximum Ocean Disposal with Galbraith)

Under this alternative, 5.4 mcy would be disposed at the ocean site, and 1.2 mcy would be disposed at Galbraith.

2.8.1.2 Alternative A2 (Maximum Ocean Disposal with Leonard Ranch)

Under this alternative, 5.4 mcy would be disposed at the ocean site, and 1.2 mcy would be dried at Leonard Ranch and disposed at Redwood Landfill once dry.

2.8.2 Maximum Wetland Restoration

There are three alternatives that would maximize wetland restoration. The main difference among them is whether Sonoma Baylands, Galbraith, Leonard Ranch, or Montezuma Wetlands would be used.

2.8.2.1 Alternative B1 (Montezuma Wetlands Available)

Under this alternative, 100,000 cy would be disposed at the ocean, up to 100,000 cy would be disposed at the Port/Landfill site, and 6.4 mcy would be disposed at Montezuma Wetlands. At Montezuma, 3.2 mcy of sediment would be suitable for cover material and 3.2 mcy would be non-cover material.

2.8.2.2 Alternative B2 (Galbraith Available)

Under this alternative, 2.9 mcy would be disposed at the ocean, 2.5 mcy would be disposed at Sonoma Baylands, and 1.2 mcy would be disposed at Galbraith.

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2.8.2.3 Alternative B3 (Leonard Ranch Available)

Under this alternative, 2.9 mcy would be disposed at the ocean, 2.5 mcy would be disposed at Sonoma Baylands, and 1.2 mcy would be dried at Leonard Ranch and disposed at Redwood Landfill once dry.

2.8.3 All Upland Disposal

Two alternatives would use only upland sites to dispose of the sediment. The difference between the two is whether Galbraith or Leonard Ranch/Redwood Landfill would be used.

2.8.3.1 Alternative C1 (Galbraith Available)

Under this alternative, 6.4 mcy would be disposed at Montezuma Wetlands, and 0.2 mcy would be disposed at Galbraith. At Montezuma, 3.2 mcy of sediment would be suitable for cover material and 3.2 mcy would be non-cover material.

2.8.3.2 Alternative C2 (Leonard Ranch Available)

Under this alternative, 6.4 mcy would be disposed at Montezuma Wetlands, and 0.2 mcy would be dried at Leonard Ranch and disposed at Redwood Landfill once dry. At Montezuma, 3.2 mcy of sediment would be suitable for cover material and 3.2 mcy would be non-cover material.

2.8.4 Alternative D1 (Maximum Confined Aquatic Disposal)

Only one alternative would maximize the use of confined aquatic disposal. Under this alternative, 6.6 mcy would be disposed at the Bay Farm Borrow Area.

2.8.5 Maximum Unconfined Aquatic Disposal

Four alternatives would maximize the use of unconfined aquatic disposal sites. The difference among the four is the amount of sediment that would be disposed at Alcatraz, Bay Farm Borrow Area, Galbraith, and Leonard Ranch/Redwood Landfill.

2.8.5.1 Alternative E1 (Alcatraz and Galbraith)

Under this alternative, 0.7 mcy would be disposed at the ocean, 4.8 mcy would be disposed at Alcatraz, and 1.2 mcy would be disposed at Galbraith.

2.8.5.2 Alternative E2 (Borrow Area and Galbraith)

Under this alternative, 0.7 mcy would be disposed at the ocean, 4.8 mcy would be disposed at the Borrow Area, and 1.2 mcy would be disposed at Galbraith.

2.8.5.3 Alternative E3 (Alcatraz and Leonard Ranch)

Under this alternative, 0.7 mcy would be disposed at the ocean, 4.8 mcy would be disposed at Alcatraz, and 1.2 mcy would be dried at Leonard Ranch with disposal at Redwood Landfill once dry.

1 **2.8.5.4 Alternative E4 (Borrow Area and Leonard Ranch)**

2
3 Under this alternative, 0.7 mcy would be disposed at the ocean, 4.8 mcy would be disposed at the
4 Borrow Area, and 1.2 mcy would be dried at Leonard Ranch with disposal at Redwood Landfill once
5 dry.
6

7 **2.9 REGULATORY AGENCY FRAMEWORK/COMPLIANCE**

8
9 An international treaty and several laws and regulations apply to disposal of dredged material. The
10 relevance of these statutes to the proposed action is described below. Compliance of the proposed action
11 is summarized in Table 2.9-1. Situations of partial compliance or non-compliance in Table 2.9-1 are
12 explained in the text of this section.
13

14 **2.9.1 International Treaty**

15
16 The principal international agreement governing ocean disposal is the Convention on the Prevention of
17 Marine Pollution by Dumping of Wastes and Other Matter (26 UST 2403: TIAS 8165), also known as
18 the London Convention (LC). This agreement became effective on August 30, 1975 after ratification by
19 the participating countries, including the United States. Ocean dumping criteria incorporated into
20 MPRSA have been adapted from the provisions of the LC. Thus, material considered acceptable for
21 ocean disposal under MPRSA also is acceptable for ocean disposal under the LC.
22

23 **2.9.2 Federal Laws and Regulations**

24 **2.9.2.1 National Environmental Policy Act of 1969 (42 U.S.C. 4341 et seq.)**

25
26
27 NEPA was established to ensure that the environmental consequences of federal actions were incorporated
28 into Agency decision-making processes. It establishes a process whereby the parties most affected by the
29 impact of a proposed action are identified and their opinions are solicited. The proposed action and
30 several alternatives are evaluated in relation to their environmental impacts, and a tentative selection of
31 the most appropriate alternative is made. A DEIS is developed that presents sufficient information to
32 evaluate the suitability of the proposed and alternative actions. A Notice of Availability, announcing that
33 the DEIS can be obtained for comment, is published in the *Federal Register*. After the DEIS comment
34 period, the comments are addressed, revisions are made to the DEIS, and the document is published as
35 a Final EIS. The Corps is the lead agency under NEPA. This document fulfills the NEPA EIS
36 requirement.
37

38 The Council on Environmental Quality (CEQ) has published regulations at 40 CFR Parts 1500 to 1508
39 for implementing NEPA. U.S. EPA NEPA regulations are published at 40 CFR Part 6. The Corps
40 regulations for implementing NEPA are published at 33 CFR Part 220.
41

42 **2.9.2.2 Clean Water Act of 1972 (33 U.S.C. 1251 et seq.)**

43
44 The CWA was passed to restore and maintain the chemical, physical, and biological integrity of the
45 Nation's waters. Specific sections of the Act control the discharge of pollutants and wastes into aquatic
46 and marine environments.
47

Table 2.9-1. Disposal Sites' Compliance with Environmental Requirements
(page 1 of 2)

Environmental Requirement	Ocean Section 102 Site	Alcatraz	Bay Farm Borrow Area	Leonard Ranch/ Redwood Landfill	Sonoma Baylands	Galbraith Golf Course	Port/ Landfill	Montezuma Wetlands
International Treaty								
London Convention	FC	NA	NA	NA	NA	NA	NA	NA
Federal Laws and Regulations								
National Environmental Policy Act	FC	FC	FC	FC	FC	FC	FC	FC
Clean Water Act	NA	FC	FC	FC	FC	FC	FC	FC
Clean Air Act	PC	PC	PC	PC	PC	PC	PC	PC
Coastal Zone Management Act (BCDC Management Plan ¹ or California Coastal Act)	FC	NC	NC	FC	FC	FC	FC	FC
Marine Protection, Research, and Sanctuaries Act	FC	NA	NA	NA	NA	NA	NA	NA
Fish and Wildlife Coordination Act	FC	FC	FC	FC	FC	FC	NA	PC
Endangered Species Act	FC	FC	FC	FC	FC	FC	FC	FC
National Historic Preservation Act	FC	FC	FC	PC	FC	FC	FC	FC
Farmland Protection Policy Act	NA	NA	NA	FC	FC	NA	NA	NA
FAA Requirements	NA	NA	NA	NA	NA	FC	NA	NA
Submerged Lands Act	NA	FC	FC	NA	NA	NA	NA	NA
Federal Water Project Recreation Act	FC	FC	FC	FC	FC	FC	NA	FC
Rivers and Harbors Act	NA	FC	FC	FC	FC	NA	NA	FC
Migratory Bird Treaty Act	FC	FC	FC	FC	NA	FC	NA	FC
Migratory Bird Conservation Act	FC	FC	FC	FC	FC	NA	NA	FC
Executive Order 12898 (Environmental Justice)	NA	NA	NA	NA	NA	FC	NA	NA

Table 2.9-1. Disposal Sites' Compliance with Environmental Requirements
(page 2 of 2)

Environmental Requirement	Ocean Section 102 Site	Alcatraz	Bay Farm Borrow Area	Leonard Ranch/ Redwood Landfill	Sonoma Baylands	Galbraith Golf Course	Port/ Landfill	Montezuma Wetlands
State of California Laws and Regulations								
California Environmental Quality Act	FC	FC	FC	FC	FC	FC	FC	PC
California Wetlands Policy	NA	NA	NA	FC	FC	FC	NA	FC
Porter-Cologne Water Quality Control Act	NA	FC	FC	FC	FC	FC	FC	FC
State Lands Commission policies	NA	NA	NA	FC	FC	FC	FC	FC
California Endangered Species Act	FC	FC	FC	FC	FC	FC	FC	FC
McAteer-Petris Act	NA	FC	FC	NA	FC	FC	NA	FC
Suisun Marsh Preservation Act	NA	FC	FC	NA	FC	FC	NA	FC
Local Laws and Regulations								
Regional Water Quality Control Board Dredging Policy for San Francisco Bay	NA	FC	FC	NA	NA	NA	NA	NA
Local Land Use Requirements	NA	NC	NC	PC	FC	PC	FC	PC

Legend: FC = Full compliance. All requirements of the law, policy, or related regulations would be met.
 PC = Partial compliance. Some requirements of the law, policy, or related regulations may not be met. Refer to the text of section 2.9 for additional information.
 NC = Not in compliance. Use of the site would conflict with the law, policy, or related regulations. Refer to the text of section 2.9 for additional information.
 NA = Not applicable. The law, policy, or related regulations do not apply to the disposal site.

Note: 1. The BCDC regulations and plans, such as the San Francisco Bay Plan and Suisun Marsh Protection Plan, constitute consistency with these plans is also considered under local laws, regulations below the approved coastal management plan for the San Francisco Bay Area under the Coastal Zone Management Act.

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1 The major section of the CWA that applies to dredging activities is Section 401, which requires
2 certification that the permitted project complies with the State Water Quality Standards for actions within
3 State waters. Under Section 301, states must establish Water Quality Standards for all state waters,
4 including the territorial sea. Dredging or disposal of dredged material may not cause the concentrations
5 of chemicals in the water column to exceed State standards. To receive State certification, a permit
6 applicant must demonstrate that these standards will not be exceeded.

7
8 Section 404(b)(1) of the CWA establishes guidelines for the discharge of dredged or fill materials into
9 the aquatic ecosystem. Subpart A, Section 230.1 (c) of the Section 404(b)(1) guidelines states the
10 following: "Fundamental to these guidelines is the precept that dredged or fill material should not be
11 discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have
12 an unacceptable adverse impact either individually or in combination with known and/or probable impacts
13 of other activities affecting the ecosystems of concern." The Section 404(b)(1) guidelines are equally
14 important and are discussed in Appendix E1 in this document. Although sections 401 and 404(b) of the
15 CWA apply, by their own terms, only to applications for federal permits, the Corps has made a policy
16 decision to apply them to their own projects. This policy is set out in Corps regulations at 33 CFR Part
17 336. Section 336.1(a) of that regulation states, "Although the Corps does not process and issue permits
18 for its own activities, the Corps authorizes its own discharges of dredge or fill material by applying all
19 applicable substantive legal requirements, including public notice, opportunity for public hearing, and
20 application of the Section 404(b)(1) guidelines." The Port has applied for Department of the Army
21 authorization under Section 404 to fill wetland and other waters of the United States at the Galbraith
22 disposal site as part of the proposed project.

23
24 The following is a summary of the conclusions of the Section 404(b)(1) evaluation described in Appendix
25 E1. Alternative B2 would have the least impact of all the practicable alternatives on the aquatic
26 environment. While the No-Action Alternative would have less impact on the aquatic environment, it
27 is not considered practicable because of the resulting adverse effects on the movement of goods and the
28 economy of the San Francisco Bay area and the nation (see section 2.3). Alternative B2 avoids disposal
29 at in-Bay sites and includes restoration of wetlands at the Sonoma Baylands site. All of the other
30 practicable alternatives entail (a) disposal at in-Bay sites; (b) elimination of wetlands sites; or (c) both
31 a and b. Disposal of dredged material at any of the sites under consideration would have adverse
32 environmental impacts. The project's impact on wetlands has been minimized by avoiding wetland areas
33 to the maximum extent practicable. In an effort to avoid wetland areas, a range of disposal options were
34 evaluated for sediments that are considered unsuitable for aquatic disposal (see Table 2.7-1). Since none
35 of the other disposal options are currently feasible, the Galbraith site was selected. Wetland impacts at
36 Galbraith would be minimized to the extent feasible by avoiding some wetland areas, but most of the on-
37 site wetland areas could not be avoided and still provide sufficient capacity to retain and dry the dredged
38 sediments (e.g., avoidance of the drainage channel would substantially reduce the site's capacity for
39 dredged sediments and thus greatly increase project costs). For the wetland areas that cannot be avoided,
40 compensatory on-site mitigation at a ratio of 1.1:1 to 1.3:1 on an acreage basis would be implemented.
41 The final ratio will be determined once the design of the mitigation areas is finalized and permitted. The
42 proposed mitigation areas will be designed to provide greater habitat value than the existing wetlands that
43 would be replaced because they will be contiguous and maintained. This would mitigate wetland impacts
44 at Galbraith to a less than significant level.

45
46 The CWA was amended in 1987 (Water Quality Act of 1987) and resulted in establishment of the EPA
47 National Estuary Program. As part of this program, the San Francisco Estuary Project was developed

as a 5-year cooperative effort between the EPA and the State of California to promote more effective management of the San Francisco-Delta Estuary and to restore and maintain the estuary's water quality and natural resources (San Francisco Estuary Project [SFEP] 1993). The result of the effort was a Comprehensive Conservation and Management Plan (CCMP) (SFEP 1993) for the San Francisco Estuary. This document addresses aquatic resources, wildlife, wetlands management, water use, pollution prevention and reduction, dredging and waterway modification, land use, public involvement and education, and research and monitoring program areas. For each program area, goals, recommended approaches, objectives, and actions are provided. A preliminary implementation strategy is included that suggests ways in which state and federal agencies can contribute to financing CCMP actions.

The CCMP dredging and waterway modification program contains five goals: eliminate unnecessary dredging activities; maximize the use of dredged material as a resource; conduct dredging activities in an environmentally sound fashion; adopt a sediment management strategy for dredging and waterway modification; and manage modification of waterways to avoid or offset the adverse impacts of dredging, flood control, channelization, and shoreline development and protection projects. Five related objectives and 18 actions are addressed. Several of the objectives highlight the need for conducting sedimentation studies and analyses, many of which are currently incorporated in the Long-Term Management Strategy Project (a multi-participant regional organization aimed at developing approaches to dredging programs and cost-sharing demands), begun in January 1990. Other objectives are directed at developing dredging project policies, standards, and procedures that would minimize impacts and maximize environmentally sensitive approaches to dredged material disposal and estuary modification.

The CWA sediment and water quality evaluation criteria are described in detail in section 4.4.1.2. Evaluation results for this project are described in section 4.4.2.

The project as it is presently defined does not incorporate mechanisms to fund proposed CCMP actions and programs. Project-specific impacts, which ensure that estuary water quality and natural resources are maintained, are addressed through project mitigation measures, but measures to assist in restoring or improving these regional CCMP aims are not. The CCMP does not, however, specifically require public agency projects to include mitigation which assists CCMP restoration programs. The mitigated project would result in maintaining estuary environmental quality, if not improving it over existing levels. Therefore, the project is considered in compliance with the CCMP goals and objectives of maintaining the estuary's water quality and natural resources.

2.9.2.3 Clean Air Act as Amended (42 U.S.C. Section 7401 *et seq.*)

The Clean Air Act (CAA) is intended to protect the Nation's air quality by regulating emissions of air pollutants. The CAA is applicable to permits and planning procedures related to dredged material disposal onshore and within the territorial sea. The territorial sea is defined as waters 3 miles seaward of the nearest shoreline. For bays or estuaries, the 3-mile territorial sea begins at a baseline drawn across the opening of the water body. Section 118 of the CAA (42 U.S.C. 7418) requires that all federal agencies engaged in activities that may result in the discharge of air pollutants comply with state and local air pollution control requirements. In addition, Section 176 of the CAA (42 U.S.C. 7506) prohibits federal agencies from engaging in any activity that does not conform to an approved State Implementation Plan.

2.9.2.4 Coastal Zone Management Act of 1972 (16 U.S.C. 1456 *et seq.*)

Under the Coastal Zone Management Act (CZMA), any federal agency conducting or supporting activities directly affecting the coastal zone must proceed in a manner consistent with approved State coastal zone management programs, to the maximum extent practicable. If a proposed activity affects water use in the coastal zone (i.e., the territorial sea and inland), the federal agency must demonstrate that the activity is consistent with the State's coastal zone management program to the maximum extent practicable. The programs applicable to the proposed project are the California Coastal Zone Management Plan (discussed in section 2.9.3.2) and the BCDC San Francisco Bay Plan (discussed in section 2.9.4.1), Suisun Marsh Protection Plan and Seaport Plan (discussed in section 2.9.4.3), special area plans, the Commission's regulations and laws, such as the McAteer-Petris and Suisun Marsh Preservation Act.

The Coastal Zone Reauthorization Amendments of 1990 (Section 6208) state that any federal activity, regardless of its location, is subject to the CZMA consistency requirement if it will affect any natural resources, land uses, or water uses in the coastal zone. No federal agency activities are categorically exempt from this requirement.

Based on the information contained in this SEIR/S, the Corps has determined that the selected plan is consistent to the maximum extent practicable with the approved California Coastal Zone Management Plan and the BCDC San Francisco Bay Plan. The Corps will submit the consistency determination to and seek concurrence from the California Coastal Commission (CCC) and the Bay Conservation and Development Commission (BCDC), and the Port will apply for a BCDC permit for the associated berth deepening.

2.9.2.5 Marine Protection, Research, and Sanctuaries Act of 1972 (Ocean Dumping Act) (33 U.S.C. 1401 *et seq.*)

The MPRSA regulates the transportation and ultimate disposal of material in the ocean, prohibits ocean disposal of certain wastes without a permit, and prohibits the disposal of certain materials entirely. Prohibited materials include those that contain radiological, chemical, or biological warfare agents, high-level radiological wastes, and industrial waste. MPRSA has jurisdiction over all United States ocean waters in and beyond the territorial sea, vessels flying the U.S. flag, and vessels leaving U.S. ports.

Section 102 of the Act authorizes EPA to promulgate environmental criteria for evaluation of all dumping permit actions, to retain authority over Corps MPRSA 103 permits, and to designate ocean disposal sites for dredged material disposal. The EPA has published a proposed rule to designate an ocean disposal site approximately 55 nautical miles offshore of San Francisco. That designation is expected to be final in June 1994. EPA's regulations for ocean disposal are published at 40 CFR Parts 220-229. The Corps and EPA would apply the same substantive requirements to Corps dredging projects as to a permitted project. The permitting regulations promulgated by the Corps, under the MPRSA, appear at 33 CFR Parts 320 to 330 and 335 to 338. Based on an evaluation of compliance with the regulatory criteria of 40 CFR Part 227, both EPA and the Corps may prohibit or restrict disposal of material that does not meet the criteria. The EPA and Corps also may determine that ocean disposal is inappropriate because of ocean dredged material disposal site (ODMDS) management restrictions or because options for beneficial use(s) exist. Site management guidance is provided in 40 CFR 228.7-228.11.

The sediment testing requirements of the MPRSA are discussed in detail in section 4.4.1.1. The results of the testing program with Oakland Harbor sediments are described in section 4.4.2.

2.9.2.6 Fish and Wildlife Coordination Act of 1958 (16 U.S.C. 661 *et seq.*)

The Fish and Wildlife Coordination Act requires that whenever any body of water is proposed or authorized to be impounded, diverted, or otherwise controlled or modified, the lead federal agency must consult with the USFWS, the State agency responsible for fish and wildlife management (in California, the Department of Fish and Game) and, for projects affecting marine fisheries, the National Marine Fisheries Service (NMFS). Section 662(b) of the Act requires the lead federal agency to consider USFWS and other agencies' recommendations. The recommendations may address wildlife conservation and development, any damage to wildlife attributable to the project, and measures proposed for mitigating or compensating for these damages. The Act is applicable to the Corps' and EPA's evaluations of consistency with CWA Section 404 and MPRSA Section 103 requirements. A Draft Fish and Wildlife Coordination Act Report (DCAR) has been prepared by the USFWS (January 1994) that addresses the Oakland Harbor Navigation Improvement Project (see Appendix H). The USFWS will coordinate the DCAR with the California Department of Fish and Game and the National Marine Fisheries Service (see USFWS letter dated May 20, 1994, in Appendix H).

2.9.2.7 Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*)

The Endangered Species Act protects threatened and endangered species by prohibiting federal actions that would jeopardize the continued existence of such species or that would result in the destruction or adverse modification of any critical habitat of such species. Section 7 of the Act requires that consultation regarding protection of such species be conducted with the USFWS and/or NMFS prior to project implementation. An updated list of proposed and listed threatened and endangered species that could be present in the project area is provided in Appendix C. During the project planning process, the USFWS and NMFS evaluate the potential impacts of all aspects of the project on threatened or endangered species. Their findings are contained in letters that provide an opinion on whether a project will jeopardize the continued existence of endangered species or modify critical habitat. If a jeopardy opinion is issued, the resource agency will provide reasonable and prudent alternatives, if any, that will avoid jeopardy. A non-jeopardy opinion may also be accompanied by reasonable and prudent measures to minimize incidental take (loss or disturbance of individuals) caused by the project. This SEIR/S is the Biological Assessment required by this Act. The conclusion of the Biological Assessment for the scheduled plan is that there would be no unmitigable impacts associated with the project. Full compliance of the disposal sites with this Act assumes that this SEIR/S will suffice as a Biological Assessment. Informal consultation with the USFWS regarding endangered species that may be present at the disposal sites has been initiated in conjunction with the CAR described in the preceding section, and the Corps will initiate formal consultation as appropriate, based on USFWS review and comment on the disposal alternatives. The USFWS letter dated May 19, 1994, concurs that the preferred alternative B2 is not likely to adversely affect federally listed threatened and endangered species.

2.9.2.8 National Historic Preservation Act of 1966 (16 U.S.C. 470 *et seq.*)

The purpose of the National Historic Preservation Act is to preserve and protect historic and prehistoric resources that may be damaged, destroyed, or made less available by a project. Under this Act, federal agencies are required to identify cultural or historical resources that may be affected by a project and to

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consult with the State Historic Preservation Officer (SHPO) when a federal action may affect cultural resources. Additional information would be required for two upland disposal sites (Leonard Ranch and Montezuma Wetlands) if they were selected for implementation. The Corps initiated Section 106 consultation regarding the proposed project with the SHPO. By letter dated June 7, 1994, the SHPO concurs with the Corps' determination that there are no historic properties within the Area of Potential Effect (APE) and, accordingly, the Corps has met its responsibilities under Section 106 of the National Historic Preservation Act.

Since the Leonard Ranch/Redwood Landfill site has not been surveyed for cultural resources, it is not known if properties potentially eligible for the National Register of Historic Places are present on site. If the site were to be selected for development, an archaeological and historical survey of the site would provide sufficient information for determining whether a cultural resources treatment plan would be required under the National Historic Preservation Act. Consultation with the SHPO regarding the project's effects on cultural resources, including development and implementation of a treatment plan if necessary, would ensure full compliance with the statute. If dredged material from the proposed project would be disposed at the Montezuma Wetlands site, the applicant or the government agency responsible for development of the disposal site would be responsible for consultation with the SHPO regarding the cultural resources within the project's area of potential effect.

2.9.2.9 Farmland Protection Policy Act of 1984

The purpose of this Act is to minimize the extent to which federal agencies contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. Federal agencies are to use the criteria in the Act (section 658.5) to identify and take into account the adverse effects of their programs on the preservation of farmland; to consider alternative actions that could lessen adverse effects; and to ensure that their programs, to the maximum extent practicable, are compatible with state and local governmental and private programs and policies to protect farmland. There are three types of criteria: land evaluation criteria, site assessment criteria, and corridor-type site assessment criteria. (This last criterion is used for projects that have a linear or corridor-type site configuration, and thus would not apply to the proposed project.) Land evaluation criteria, which focus on a site's soils, are used to assign a numeric score to groups of soils within a local government's jurisdiction. This score represents the relative value, for agricultural production, of the farmland that would be converted to non-agricultural uses by the project compared to other farmland in the same local government jurisdiction. There are 12 main site assessment criteria. These criteria consider the site in relationship to its surroundings. Scoring thus takes into account the current capability of the site for farm use and the surrounding land uses. The score of the site, together with that of alternatives, are then to be considered in the final design and implementation of the proposed project.

An agency should first make a request to the Soil Conservation Service (SCS) on Form AD 1006 (Farmland Conversion Impact Rating Form) for determination of whether a given site is farmland subject to the Act. If the SCS determines that the Act applies to the site, then the SCS will measure the relative value of the site as farmland on a scale of 0 to 100 using the land evaluation criteria. The SCS is obligated to respond to an agency's request for this determination within 45 calendar days. If they fail to respond within this period and if further delays would interfere with project construction, the agency may proceed as though the site were not subject to the Act.

Both sites are currently used for the production of oat hay. Also, both sites are under a Type A-II Agricultural Preserve (Williamson Act) contract, and use of the sites for dredged material would remove them from agricultural production. According to the U.S. Soil Conservation Service, neither site is considered prime or unique farmland, or farmland of statewide or local importance under the Farmland Protection Act.

2.9.2.10 FAA Airport Facilities/Airspace Development Constraints

The Galbraith Golf Course site would be subject to the Federal Aviation Administration (FAA) Airport Facilities/Airspace Development Constraints. This site would be designed in full compliance with the restrictions regarding: (1) the runway approach zone; (2) the 50:1 approach slope surface; and (3) the approach lighting system. The Port and the FAA agree that an Airport Layout Plan Review is not necessary for this project, but that an Airspace Review is required. Due to the FAA actions involved, a Section 4(f) evaluation has been prepared pursuant to the requirements of the Department of Transportation Act, 49 U.S.C. 303. This evaluation is included in Appendix I. The FAA has reviewed the proposed plan and has determined that it will not affect existing or proposed FAA facilities or program responsibilities (Rodriquez 1994).

2.9.2.11 Submerged Lands Act (Public Law 82-3167; 43 U.S.C. 1301 *et seq*)

This Act, which was passed by Congress in 1953, authorized coastal states to extend their state boundaries seaward to include "lands beneath navigable waters" to a distance of 3 miles offshore from the low tide line. Under this Act, the federal government relinquished all of its rights to lands beneath navigable waters within the 3-mile limit, and the respective states were granted ownership of all resources within these lands and waters. The federal government retained its rights and powers regarding regulation of these lands and waters for the constitutional purposes of commerce, navigation, national defense, and international affairs.

As a result of this Act, that portion of the continental shelf beyond the 3-mile limit became known as the *outer* continental shelf (OCS). The OCS lands remain under the ownership and control of the federal government.

2.9.2.12 Federal Water Project Recreation Act (Public Law 89-72)

This Act, which was passed by Congress in 1965, established the federal policy that any investigation or plan for any federal navigation, flood control, reclamation, hydroelectric, or multi-purpose water resource project must give full consideration to the opportunities for outdoor recreation and for fish and wildlife enhancement. Wherever any such project can reasonably serve either or both of these purposes, it must be constructed, operated, and maintained accordingly.

2.9.2.13 Rivers and Harbors Act of 1899 (33 U.S.C. 403 *et seq.*)

This Act prohibits the obstruction or alteration of navigable waters of the United States without a permit from the U.S. Army Corps of Engineers (COE). Specifically, all types of development in or over navigable waters, including bridges, dams, dikes, piers, wharfs, booms, weirs, jetties, dredging, and filling are regulated by requiring a COE permit for such actions. Navigable waters are defined in 33 CFR § 329 as those waters that are subject to the ebb and flow of the tide and/or have been used in the

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past, or may in the future be used to transport interstate or foreign commerce. Court decisions have expanded protection to estuaries and wetlands. This Act, read in conjunction with the Fish and Wildlife Coordination Act (16 U.S.C. 661-666) and the National Environmental Policy Act of 1969 (42 U.S.C. 4331-4347), permits the COE to refuse on conservation grounds to grant a permit to dredge or fill in navigable waters.

2.9.2.14 Migratory Bird Treaty Act (16 U.S.C. 703 et seq.)

This Act protects certain migratory birds by limiting the hunting, capturing, selling, purchasing, transporting, importing, exporting, killing, or possession of these birds or their nests or eggs. The specific migratory birds covered are identified in separate agreements between the United States and the countries of Great Britain, Mexico, and Japan.

2.9.2.15 Migratory Bird Conservation Act (16 U.S.C. 715 et seq.)

This Act, which was passed by Congress in 1929, protects migratory birds by creating the Migratory Bird Conservation Commission. The Commission's purpose is to consider and approve the purchase, rental, or other acquisition of any areas of land or water that may be recommended by the Secretary of Interior for the purpose of establishing sanctuaries for migratory birds.

2.9.2.16 Environmental Justice Executive Order (EO 12898)

A Presidential Memorandum and this Executive Order, entitled *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, were signed by President Clinton on February 11, 1994. The Executive Order requires that, "To the greatest extent practicable . . . each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations . . . " The Presidential Memorandum further requires that each federal agency ensure that opportunities are presented for affected communities to provide input into the NEPA process, including identification of mitigation measures.

Consideration of this Executive Order in NEPA documentation ensures that two questions are asked: (1) Is a federal project with significant adverse environmental impacts being proposed in a community that is comprised largely of minority or low-income persons? and (2) Would any significant adverse human health or environmental effects of the project disproportionately affect minority or low-income persons?

The significant impacts on people from the proposed project are impacts on air quality and recreation (which is discussed under land use). Potential human health risks associated with the project were evaluated in a Human Health Risk Assessment, and the impacts were determined to be not significant (see section 4.9) There would be significant, unmitigable impacts on air quality at the dredge site (see section 4.1.3) and at any of the disposal sites considered (see section 4.1.4). For the selected plan, Alternative B2, the disposal sites would include the proposed Ocean Section 102 site, Sonoma Baylands, Galbraith Golf Course and, if required by the RWQCB, the Port/Landfill disposal option. Because the pollutant emissions that would cause this impact would be spread over a large portion of the Bay Area, minority or low-income communities would not be disproportionately affected. The air quality impacts associated with the project are thus not an environmental justice issue.

The significant impact on recreation would be lost golfing opportunities for golfers at the Galbraith Golf Course during the 7-year period when this site would be used as a disposal site. Based on information submitted in comment letters on the Draft SEIR/S, general golfers at the course (i.e., golfers other than participants in the junior golf program) appear to represent the full socioeconomic spectrum of the Bay Area. Lost golfing opportunities for this group, although unmitigated, would not disproportionately affect minority or low-income people, and are thus not an environmental justice issue. Similarly, senior golfers at the Galbraith Golf Course appear to also represent the full socioeconomic spectrum, so impacts on senior golfers, which would largely be mitigated, are not an environmental justice issue. The only group of golfers at the golf course that does have a large minority or low-income component is the youth involved in the informal junior golfing program. The impact on this group and its environmental justice implications are discussed in section 5.3.6. With the proposed mitigation measures listed in section 5.3.6.3, which would reduce the impact on this group to insignificance, the purpose and intent of Executive Order 12898 would be satisfied.

The other significant impacts of the selected plan that could *potentially* affect people would also occur from use of the Galbraith site and are related to hydrology (degradation of groundwater or surface water quality), seismicity (potential levee failure from a large earthquake), and noise (from the unloading station and booster pumps). None of these impacts are considered environmental justice issues for the following reasons. All of these impacts would be mitigated to insignificance, and the first two impacts would not affect people. Neither the groundwater nor the surface water in the vicinity of Galbraith is used by people. A potential levee failure would affect the immediate industrial area surrounding Galbraith (e.g., Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant) and would thus not disproportionately impact minority or low-income people. With respect to potential noise impacts, it is unknown exactly where the unloading station would be. Under Option A, the unloading station would be in San Leandro Bay. Under Option B it would be offshore in San Francisco Bay, possibly as far as 3 miles away from the site. Neither of these two possible locations would disproportionately affect minority or low-income people. The booster pump under Option A would probably be near the golf course. Under Option B, there could be two booster pumps: on the airport dike and/or at the golf course. Regardless of whether Option A or B is selected, the booster pump(s) would be in an industrial area, near the airport which has relatively high background noise levels, and would thus not disproportionately affect minority or low-income people. Again, each of these impacts would be mitigated to insignificance, and would not disproportionately affect minority or low-income people.

Impacts at any of the other sites involved in the selected plan -- the dredging site, the proposed Ocean Section 102 site, Sonoma Baylands and, if required by the Regional Water Quality Control Board, the Ninth Avenue Marine Terminal -- would not disproportionately affect minority or low-income people. The dredging site in Oakland Harbor is in an industrial area (e.g., Alameda Naval Shipyard), and the ocean site is located over 20 miles offshore the Bay Area. Sonoma Baylands is primarily an agricultural area with some residential development, but it is not near a minority or low-income community. Finally, Ninth Avenue Marine Terminal is on Port property, an industrial area.

Regarding the Executive Order's requirement to ensure that potentially affected minority or low-income communities have opportunities to provide input into the NEPA process, a list of meetings with the Oakland Community Development Districts (where the dredging project and the possible disposal at Galbraith were presented and discussed) is provided in section 13.3.

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Executive Order 12898 provides for an Environmental Justice Working Group with a 24-month environmental justice strategy development schedule. But the Presidential Memorandum accompanying the Executive Order directs each federal agency to begin implementing specific directives immediately. One of the directives requires federal agencies to identify and address environmental justice issues in NEPA documents and to include measures to mitigate significant and adverse environmental effects of proposed federal actions on minority and low-income populations.

2.9.3 State of California Laws and Regulations

2.9.3.1 California Environmental Quality Act, June 1987 Public Resources Code Parts 21000-21177

CEQA establishes requirements similar to those of NEPA for consideration of environmental impacts and alternatives, and for preparation of an Environmental Impact Report (EIR) prior to implementation of applicable projects. CEQA, however, requires that significant environmental impacts be mitigated to a level of insignificance, or to the maximum extent feasible. If full mitigation is not feasible, the state lead agency must make a finding of overriding considerations before approving the project. The proposed action falls under the purview of the CEQA. This document fulfills the CEQA EIR requirement. The Port is the lead agency under CEQA. Responsible agencies (public agencies other than the lead agency that have responsibility for carrying out or approving a project) include California Coastal Commission, State Lands Commission, San Francisco Bay Conservation and Development Commission, Regional Water Quality Control Board, Bay Area Air Quality Management District, California Coastal Conservancy, and the City of Oakland.

2.9.3.2 California Coastal Act of 1976, Public Resources Code Section 3000 et seq.

This Act establishes the State Coastal Zone Management Plan (CZMP), which has been approved by the U.S. Department of Commerce. All federal actions that affect the coastal zone must be determined to be as consistent as practicable with this plan (see CZMA above).

2.9.3.3 California Wetlands Policy

The state policy recognizes the value of marshlands and other wetlands. The California Resources Agency and its various departments do not authorize or approve projects that fill or otherwise harm or destroy coastal, estuarine, or inland wetlands. Exceptions may be granted if all the following conditions are met: the project is water-dependent; there is no other feasible alternative available; the public trust is not adversely affected; and adequate compensation is part of the project.

Neither of the alternative sites for in-Bay disposal would affect wetlands. Implementation of the Leonard Ranch, Sonoma Baylands, Galbraith Golf Course, and Montezuma Wetlands disposal alternatives would require evaluation of potential wetland impacts and mitigation (this evaluation is included in this document) as well as review and approval by appropriate regional, state, and federal agencies.

1 **2.9.3.4 Porter-Cologne Water Quality Control Act of 1966 (California Water Code Sec. 13000**
2 **et seq.; CCR Title 23, Chapter 3, Subchapter 15)**
3

4 The Porter-Cologne Act is the primary state regulation that addresses water quality. The requirements
5 of the Act are implemented by the State Water Resources Control Board (SWRCB) at the state level and,
6 at the local level, RWQCBs. Under the direction of the SWRCB, the RWQCBs carry out planning,
7 permitting, and enforcement activities related to water quality in California. The San Francisco Bay
8 RWQCB has jurisdiction over the Bay downstream of Chipps Island. The Act provides for waste
9 discharge requirements and a permitting system for discharges to land or water. The Act also provides
10 for Basin plans to identify beneficial uses of water resources and to implement appropriate controls. As
11 part of protecting San Francisco Bay, the Act provides for the identification of water pollution "hot
12 spots," submission of clean-up plans for hot spots, and the prevention of new hot spots. Full compliance
13 of the Alcatraz and Bay Farm Borrow Area disposal sites with this Act assumes that the RWQCB accepts
14 compliance with the CWA.
15

16 **2.9.3.5 State Lands Commission Policies**
17

18 The State Lands Commission (SLC) is responsible for administration of state public trust lands in coastal
19 waters (within a 3-mile territorial limit) and other tidal and submerged areas. The State's interest in these
20 lands consists of sovereign fee ownership, or a Public Trust easement implicitly retained by the State over
21 sovereign lands sold into private ownership. Use of these lands, including dredging and dredged material
22 disposal activities, requires written authorization from the SLC. The SLC reviews dredging projects for
23 compliance with CEQA. In some cases, the State Legislature has granted, by statute, administration of
24 the State's interests in filled and unfilled tidelands and submerged lands to local agencies. In these cases,
25 SLC retains an oversight role. A portion of the proposed dredging will be subject to SLC permit
26 requirements. Based on the historic tidal character of some of the dredged material disposal sites
27 evaluated in this SEIR/S, the SLC may have jurisdictional interests in some of the proposed upland
28 disposal sites. The SLC has indicated that the State's interests in Sonoma Baylands may consist of a fee
29 and/or a Public Trust easement over the last natural slough beds. The SLC has also indicated that the
30 Montezuma Wetlands site is a sovereign fee land owned by the State, and the Galbraith Golf Course site
31 may involve sovereign tidelands subject to Public Trust easement. The Port has indicated that sovereign
32 tidelands in the Galbraith site, if any, have been granted to the Port.
33

34 **2.9.3.6 California Endangered Species Act of 1984, Fish and Game Code Section 2050 et. seq.**
35

36 The California Endangered Species Act provides for the recognition and protection of rare, threatened,
37 and endangered species of plants and animals. The Act requires state agencies to consult with the
38 California Department of Fish and Game (CDFG) to ensure that state-authorized or funded actions do
39 not jeopardize the continued existence of a listed species. The Act prohibits the taking (collection,
40 killing, or injury, whether intentional or accidental) of listed species without authorization from the
41 CDFG. CDFG may authorize the taking of a listed species through a Memorandum of Understanding
42 that establishes the extent of take permitted by CDFG and sets forth the required mitigation.
43

44 **2.9.3.7 McAteer-Petris Act**
45

46 This Act established the BCDC as the agency responsible for maintaining and carrying out the provisions
47 of the Act and the Bay Plan for the protection of the Bay and its natural resources and the development

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of the Bay and shoreline to their highest potential with a minimum of Bay fill. The Act directs the BCDC to exercise its authority to issue or deny permit applications for placing fill, extracting materials, or changing the use of any land, water, or structure within the area of its jurisdiction, in conformity with the provisions and policies of both the McAteer-Petris Act and the San Francisco Bay Plan. The Act specifies that the BCDC may amend or make other changes to the Bay Plan provided the changes are consistent with provisions of the Act.

2.9.3.8 Suisun Marsh Preservation Act of 1977

This Act established primary and secondary management areas and directed the establishment of procedures for carrying out provisions of the Suisun Marsh Protection Plan and the Suisun Marsh Preservation Act in those areas. The Act specifies that appropriate policies of the San Francisco Bay Plan and the Suisun Marsh Protection Plan shall apply to the BCDC's area of jurisdiction and that if a conflict occurs between the two plans, the policies of the Suisun Marsh Protection Plan shall control.

2.9.4 Local Laws and Regulations

2.9.4.1 BCDC San Francisco Bay Plan

In response to the mandate of the McAteer-Petris Act, BCDC developed the San Francisco *Bay Plan* in 1968. The *Bay Plan* is a comprehensive and enforceable plan for the conservation of the water of San Francisco Bay and the development of its shoreline. The latest amendments to the Plan were completed in 1992. The BCDC *Bay Plan* specifies findings and policies for the management of Bay resources and developments of San Francisco Bay and its shoreline, including dredging and water-related industry. (Other BCDC plans are addressed in section 2.9.4.3 under each relevant disposal site.)

In-Bay disposal alternatives are affected by BCDC policies to varying degrees. The concept of island creation using dredged material was dropped from consideration because it is discouraged under BCDC policy and because permits for this activity historically have been denied by BCDC. The amended *Bay Plan* policies are:

- Policy 1. Dredging should be authorized when the Commission can find that (a) the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, (b) the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board, (c) important fisheries and Bay natural resources would be protected, and (d) the materials would be disposed of in accordance with Policy 2.
- Policy 2. Disposal of dredged materials should be encouraged in non-tidal areas where the materials can be used beneficially, or in the ocean. Disposal in tidal areas of the Bay should be authorized when the BCDC can find that (a) the applicant has demonstrated that non-tidal and ocean disposal is infeasible; because there are no alternate sites available or likely to be available for use in a reasonable period, or the cost of disposal at alternate sites is prohibitively expensive; (b) disposal would be at a site designated by the BCDC; (c) the quality and volume of the material to be disposed is consistent with the advice of the San Francisco Bay RWQCB; and (d) the period of disposal is consistent with the advice of the CDFG and the NMFS.

- 1 Policy 3. When the annual amount of dredged material proposed to be disposed in tidal areas of the
2 Bay exceeds the disposal volume targets established by the BCDC, in determining which
3 projects to authorize, the BCDC shall be guided by all relevant factors concerning the
4 proposed projects, including but not limited to, need for the dredging and the dredging
5 project, regional economic impact, environmental impact, and other regional effects of the
6 project, and the economic feasibility of using alternate disposal sites.
7
- 8 Policy 4. To ensure adequate capacity for necessary Bay dredging projects and to protect Bay natural
9 resources, acceptable non-tidal disposal sites should be secured and ocean disposal sites
10 designated. Further, disposal projects should maximize use of dredged materials as a
11 resource, such as creating, enhancing, or restoring tidal and managed wetlands, creating and
12 maintaining levees and dikes, providing cover and sealing material for sanitary landfills, and
13 filling at approved construction projects.
14
- 15 Policy 5. Once non-tidal or ocean disposal sites have been secured or designated, and prior to
16 completion of the LTMS, the maximum feasible amount of dredged material should be
17 disposed of at non-tidal sites or in the ocean. Until non-tidal upland disposal sites are
18 secured and ocean disposal sites designated, aquatic disposal in the Bay should be authorized
19 at sites designated by the Corps and the BCDC. Dredged materials disposed of aquatically
20 in the Bay, particularly at the Alcatraz Island disposal site, should be carefully managed to
21 ensure that the amount and timing of disposal does not create navigational hazards, adversely
22 affect Bay currents or natural resources of the Bay, or foreclose the use of the site by
23 projects critical to the economy of the Bay Area.
24
- 25 Policy 6. All proposed channels should be carefully designed so as not to undermine the stability of
26 any adjacent dikes, fills, or fish and wildlife habitats.
27
- 28 Policy 7. The BCDC should encourage increased efforts by soil conservation districts and public works
29 agencies in the 50,000-square-mile Bay tributary area to continuously reduce soil erosion as
30 much as possible.
31
- 32 Policy 8. To protect underground fresh water reservoirs (aquifers), (a) all proposals for dredging or
33 construction of work that could penetrate the mud "cover" should be reviewed by the
34 RWQCB and the State Department of Water Resources, and (b) dredging or construction
35 work should not be permitted that might reasonably be expected to damage an underground
36 water reservoir. Applicants for permission to dredge should be required to provide
37 additional data on groundwater conditions in the area of construction to the extent necessary
38 and reasonable in relation to the proposed project.
39
- 40 Policy 9. Interested agencies and parties are encouraged to explore and find funding solutions to the
41 additional costs incurred by transporting dredged materials to non-tidal upland and ocean
42 disposal sites, either by general funds contributed by ports and other relevant parties,
43 dredging applicants or otherwise.
44
- 45 Policy 10. Dredged materials should only be used to create artificial islands in the Bay if competent
46 studies demonstrate that these fill islands would have no harmful effect on Bay natural
47 resources.

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Policy 11. The BCDC should encourage, sponsor, and participate in the LTMS and other initiatives conducting research on Bay sediment movement, the effects of dredging and disposal on Bay natural resources, alternatives to Bay aquatic disposal, and funding additional costs of transporting dredged materials to non-tidal upland and ocean disposal sites.

The proposed project would be consistent with the Bay Plan and McAteer Petris Act. The only disposal sites that would involve in-Bay disposal of new work material from Oakland Harbor, Alcatraz and the BFBA, would be inconsistent with the Bay Plan, and have been deleted from consideration. Disposal at either Alcatraz or the Bay Farm Borrow Area is considered in non-compliance with the Bay Plan for the following reasons. Disposal at either of these in-Bay sites would comply with the Bay Plan's dredging policy #2 only if, among other things, the applicant (i.e., the Corps) demonstrated that (1) non-tidal and/or ocean disposal was infeasible; and (2) disposal of material was consistent with the advice of the Regional Water Quality Control Board, the California Department of Fish and Game, and the National Marine Fisheries Service. Since non-tidal and ocean disposal is considered feasible for the project, use of Alcatraz would thus be inconsistent with the Bay Plan. In addition, pursuant to the Bay Plan's dredging policy #5, use of the Alcatraz site would comply with the BCDC's laws and policies only if disposed material is carefully managed to ensure that the amount and timing of disposal does not create navigational hazards, does not adversely affect Bay currents or its natural resources, or does not foreclose the use of the site by other projects critical to the regional economy. Since the project would potentially preclude use of the site for disposal of sediment from the maintenance dredging projects for existing navigation channels, it would be inconsistent with this policy.

A BCDC permit will be secured for dredging the eight berths inside the Bay. Beneficial uses of sediment disposal would create wetlands at the Sonoma Baylands site.

2.9.4.2 Regional Water Quality Control Board

The RWQCB and EPA are responsible for determining appropriate dredged material pollutant testing and discharge standards and for assuring that dredging and the disposal of dredged materials are consistent with the maintenance of Bay water quality. The EPA and the Corps have joint federal responsibility for regulating ocean, Bay, and wetland disposal (BCDC Finding i). Compliance with Regional Water Quality Control Board requirements are an integral part of the BCDC Bay Plan policies (see section 2.9.4.1).

2.9.4.3 Local Land Use Requirements

Local land use requirements vary for different project elements depending on the location of the project element. A portion of the dredging area in Oakland Harbor and two disposal sites, Galbraith Golf Course and the Port property at Ninth Avenue Marine Terminal, are located in Alameda County, and the Galbraith site is on Port property within the city limits of Oakland. A portion of the dredging area is located in the City and County of San Francisco and a portion is located with the city of Alameda in Alameda County. Leonard Ranch and Sonoma Baylands are located in Sonoma County. Redwood Landfill, which would be used in combination with Leonard Ranch, is in Marin County. The Montezuma Wetlands site is located in Solano County. Local agencies have no jurisdiction over the ocean site or Alcatraz. The City of Alameda has jurisdiction over portions of the Bay Farm Borrow Area. The dredging area and various disposal options are thus distributed over a five-county area: Alameda, San Francisco, Marin, Sonoma, and Solano counties. The land use requirements of these five counties vary, and are fully discussed under the applicable project element in Chapter 5 on land use plans and policies.

Situations of non-compliance or partial compliance with local land use requirements ("NC" or "PC" in Table 2.9-1, respectively) are discussed below.

Use of either the Alcatraz site or the Bay Farm Borrow Area for new work material from Oakland Harbor would be in non-compliance with local land use requirements because these disposal sites would not be consistent with the Bay Plan (see section 2.9.4.1).

The Leonard Ranch site is designated as LEA (Land Extensive Agriculture) in the Land Use Element of the Sonoma County General Plan. General Plan goals seek to protect lands currently in agricultural production, to retain large parcel sizes, and to avoid incompatible non-agricultural uses. The General Plan discourages the conversion of lands currently used for agricultural production to non-agricultural uses, but provides that public uses may be approved if an overriding public benefit exists. The proposed rehandling facility would be inconsistent with the General Plan's policy to avoid conversion of lands in agricultural use unless it can be demonstrated that the facility would constitute an overriding public benefit. The proposed facility would be consistent with the General Plan's goal of retaining large parcel sizes and would be compatible with agricultural uses in the area.

The site is designated as a Scenic Resources Combining District and is adjacent to the State Route (SR) 37 Scenic Corridor. General Plan policy is to preserve the visual character and scenic resources of the county. The containment levee, proposed to be constructed to a height of +7.5 feet, would obstruct views to the south from SR 37 and Lakeville Highway, and would thus conflict with the General Plan. This impact is described under the Visual Characteristics subsection, in Chapter 5, land use plans and policies.

The Leonard Ranch site is zoned LEA; F2 (Secondary Floodplain); B6-100 (1 unit/100 acres density); SR (Scenic Resources) and is in an Agricultural Preserve. The proposed rehandling facility would require zoning clearance, with environmental review based upon this CEQA document, from the County of Sonoma to ensure General Plan consistency.

A new lease from the City of Oakland would be required for use of the Galbraith Golf Course site for sediment disposal. Development of this lease is in progress. This site is also within the area subject to the Alameda County Airport Land Use Policy Plan. As such, the project must be consistent with the General Referral Area, Height Referral Area, Noise Zone, and Safety Zone portions of the plan.

Use of the Montezuma Wetlands site is directed by the plans of several local, state, and federal agencies. The relevant local plans are the *Solano County General Plan*, *Collinsville-Montezuma Hills Area Plan and Program*, and the *Solano County Local Protection Plan (LPP)*. The BCDC has three plans that apply to the project site: the *Suisun Marsh Plan*, the *Solano County Local Protection Plan*, and the *San Francisco Bay Plan*. The San Francisco Bay RWQCB's *Basin Plan* also applies to the project.

The applicants for the Montezuma Wetlands project are requesting an amendment to policies contained in several elements of the *Solano County General Plan (Land Use and Circulation Element, Resource Conservation and Land Use Element, and Collinsville-Montezuma Hills Area Plan and Program)*. In addition, an amendment to the Zoning Ordinance has been requested. The proposed amendments would allow for use of dredged spoils to restore wetlands on the western half of the site. The changes would specifically identify dredged materials as appropriate fill material for creation of the wetland areas. Similar amendments have been proposed to the BCDC's *Suisun Marsh Protection Plan* and *LPP*. The

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amendments would allow placement of dredged material in the low-lying areas of the primary management area on the western half of the site to create wetlands and would allow marsh enhancement in the Water-Related Industrial and Port Priority Use Area on the eastern half of the site. Although not requested, it appears that the project also would require similar changes to the policies in the *Bay Plan*, *Seaport Plan*, and federally approved Coastal Zone Management Program (Solano County 1993).

Potential land use impacts and policy inconsistencies were noted in the administrative draft EIR/S prepared for the Montezuma Wetlands Project (Solano County 1993). However, if this disposal site is selected for the proposed project, it is assumed that appropriate plan and policy amendments will be in place, and that the land use impacts will be mitigated to the extent feasible through the environmental review and permit process. If dredged material from the proposed project were to be disposed at this facility, it would be consistent with the facility's permitted use. Potential land use impacts would result from conversion of the site to a disposal site, an action that is separate from the proposed Oakland Harbor deepening project. Therefore, land use impacts would be addressed fully in the EIR/EIS for the Montezuma Wetlands Project, being prepared by Solano County, not the SEIR/S for the Oakland Harbor project.

2.9.5 Permits or Approvals Required to Implement the Selected Plan

Implementation of the Selected Plan (which includes the Ocean Section 102 site, Sonoma Baylands, Galbraith Golf Course, and the Port/Landfill disposal option) would require the following permits or approvals.

Permits/Approvals to be Obtained by the Corps of Engineers

- Section 401 (Clean Water Act) certification from the RWQCB for dredging.
- Section 401 (Clean Water Act) permit to allow barge overflow at the dredge site.
- EPA concurrence with ocean disposal.
- Consistency determination concurrence from:
 - The California Coastal Commission for ocean disposal, and
 - The Bay Conservation and Development Commission (BCDC) for dredging, and pipeline facilities work at Sonoma Baylands and Galbraith within BCDC jurisdiction.

Permits/Approvals to be Obtained by the Port of Oakland

- Section 10 (River and Harbor Act) permit from the Corps for dredging of berthing areas.
- Section 10/404 (Clean Water Act) permit from the Corps for filling portions of the Galbraith site and culverting a drainage channel.
- Section 103 (Marine Protection, Research, and Sanctuaries Act) permit from the Corps for ocean dumping of some of the materials to be dredged from the berthing areas.

- State Lands Commission permit for dredging of certain lands in the Inner Harbor.
- Streambed alteration agreement from the California Department of Fish and Game for alteration of the drainage channel through the Galbraith site.
- A new lease with the City of Oakland to allow disposal at the Galbraith site.
- Air Space Review by the Federal Aviation Administration (FAA) for the Galbraith site.
- Alameda County Airport Land Use Commission (ALUC) informal project review for use of the Galbraith site.
- From the Regional Water Quality Control Board:
 - Waste discharge permit and NPDES permit for disposal at the Galbraith site.
 - Waste discharge permit for the drying yard at the Ninth Avenue Terminal, if needed.
- Miscellaneous construction easements for the Galbraith site.

Permits/Approvals to be Obtained by the Dredging Contractor

- A permit from the Bay Area Air Quality Management District (BAAQMD) for the dredge and only if:
 - The dredge is tied up to a dock or pier; or
 - The dredge offloads dredged materials directly onto land.
- A permit may also be required from the BAAQMD for operating the pumps on the dredged material pipeline.

3.0 AFFECTED ENVIRONMENT

The existing environment at the eight potential disposal sites is described in this section with respect to air quality; hydrology, groundwater, and water quality; geology, soils, and seismicity; biological resources; cultural resources; noise; socioeconomics; and transportation and circulation. SAIC prepared the analysis for the proposed Ocean Section 102 site, Alcatraz, Bay Farm Borrow Area, and the Montezuma Wetlands site. The description of the existing environment at these sites is based largely on the following environmental documents that were identified as key references.

<u>Disposal Site</u>	<u>Key References</u>
OCEAN SECTION 102	<i>Final EIS for San Francisco Bay Deep Water Dredged Material Disposal Site Designation</i> (EPA 1993a). <i>Ocean Dumping; Proposed Designation of Site</i> (EPA 1994a). <i>Proposed Site Management and Monitoring Plan for an Ocean Dredged Material Disposal Site off San Francisco, California</i> (EPA 1994b).
ALCATRAZ	<i>Appendix D, Finding of No Significant Impact (FONSI) and Environmental Assessment, Oakland Inner Harbor 38-Foot Separable Element of the Oakland Harbor Navigation Improvement Project, Design Memorandum, Alameda County, California</i> (COE 1992a). <i>Oakland Harbor Deep Draft Navigation Improvements, Design Memorandum #1 (General Design), and Final Supplement to the Environmental Impact Statement, Alameda County, California</i> (COE 1988).
BAY FARM BORROW AREA	<i>Central San Francisco Bay Projects -- Dredged Material Disposal Site Investigation</i> (PTI 1989). <i>Survey of the Bay Farm Borrow Area, San Francisco Bay, August 1991, Final Report.</i> Submitted to the U.S. Army Corps of Engineers, San Francisco District (SAIC 1992a). <i>Survey of the Bay Farm Borrow Area, San Francisco Bay, December 1991, Final Report.</i> Submitted to the U.S. Army Corps of Engineers, San Francisco District (SAIC 1992b). <i>Survey of the Bay Farm Borrow Area, San Francisco Bay, February 1992, Final Report.</i> Submitted to the U.S. Army Corps of Engineers, San Francisco District (SAIC 1992c). <i>Survey of the Bay Farm Borrow Area, San Francisco Bay, May 1992, Final Report.</i> Submitted to the U.S. Army Corps of Engineers, San

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1 Francisco District (SAIC 1992d).

2
3 *Survey of the Bay Farm Borrow Area, San Francisco Bay, August 1992,*
4 *Final Report.* Submitted to the U.S. Army Corps of Engineers, San
5 Francisco District (SAIC 1993a).

6
7 *Interim Data Report. Bay Farm Borrow Area. February 1993. Water*
8 *Column Survey* (SAIC 1993b).

9
10 *Interim Data Report. Bay Farm Borrow Area. May/June 1993. Water*
11 *Column Survey* (SAIC 1993c).

12
13 *Interim Data Report. Bay Farm Borrow Area. August 1993. Water*
14 *Column Survey* (SAIC 1993d).

15
16 *Interim Data Report. Bay Farm Borrow Area. November 1993. Water*
17 *Column Survey.* (SAIC 1993e).

18
19 MONTEZUMA WETLANDS *Administrative Draft Environmental Impact Report/Environmental Impact*
20 *Statement, Montezuma Wetlands Project, prepared by Brady and*
21 *Associates (Solano County 1993).*

22
23 Harding Lawson Associates (HLA), a consultant under contract to the Port of Oakland, prepared the
24 description of the existing environment at the other four upland sites: the Leonard Ranch/Redwood
25 Landfill option, Sonoma Baylands, Galbraith, and the Port/Landfill option. The description of the
26 existing environment at the first three sites is based largely on the following environmental documents
27 that were identified as key references.

28
29 LEONARD RANCH *Long-Term Management Strategy, Engineering Elements of Dredged*
30 *Material Rehandling Facilities, LTMS Reuse/Nonaquatic Studies, Task*
31 *3 (Gahagan & Bryant Associates 1992).*

32
33 *Sonoma Baylands and Leonard Ranch Special-Status Taxa Surveys,*
34 *Sonoma County, California.* HLA Project No. 23026 14. (Harding
35 Lawson 1993c).

36
37 SONOMA BAYLANDS *Sonoma Baylands Enhancement Project* (Technical Studies, Entrix, Inc.,
38 1991).

39
40 *Sonoma Baylands and Leonard Ranch Special-Status Taxa Surveys,*
41 *Sonoma County, California.* HLA Project No. 23026 14. (Harding
42 Lawson 1993c).

43
44 GALBRAITH GOLF COURSE *Preliminary Geotechnical Engineering Investigation, Galbraith Dredge*
45 *Disposal Site, Oakland, California* (Subsurface Consultants, Inc. 1991).

46
47 *Report on Preliminary Groundwater Quality Investigation, Galbraith Golf*

1 *Course, Oakland, California* (Baseline Environmental Consulting 1991).

2
3 *Galbraith Golf Course Special-Status Species Surveys* (H.T. Harvey and
4 Associates 1993).
5

3.1 AIR QUALITY

Air quality at a given location can be described by the concentrations of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The significance of a pollutant concentration is determined by comparing the concentration to an appropriate federal and/or state ambient air quality standard. The standards represent the allowable atmospheric concentrations at which the public health and welfare are protected and include a reasonable margin of safety to protect the more sensitive individuals in the population. Federal standards, established by the EPA, are termed the National Ambient Air Quality Standards (NAAQS). The NAAQS are defined as the maximum acceptable concentrations that may not be exceeded more than once per year, except the annual standards, which may never be exceeded. The state standards, established by the California Air Resources Board (ARB), are termed the California Ambient Air Quality Standards (CAAQS). The CAAQS are defined as the maximum acceptable pollutant concentrations that are not to be equaled or exceeded. The N/CAAQS are presented in Table 3.1-1. The pollutants of main concern that are considered in this analysis include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter smaller than 10 microns in diameter (PM_{10}).

Identifying the Region of Influence (ROI) for air quality requires knowledge of the types of pollutants being emitted, the emission rates and release parameters of the pollutant source (e.g., release temperature, area of release, release height, etc.), the source proximity to other pollutant sources, and local and regional meteorological conditions. The ROI for emissions of inert pollutants (all pollutants other than O_3 and its precursors) is generally limited to a few miles downwind from a source.

The ROI for O_3 can extend much farther downwind than for inert pollutants. Ozone is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants, or precursors. Ozone precursors are mainly the reactive organic gas (ROG) portion of volatile organic compounds (VOC) and oxides of nitrogen (NO_x). In the presence of solar radiation, the maximum effect of ROG and NO_x emissions on O_3 levels usually occurs several hours after they are emitted and many miles from the source. Ozone and O_3 precursors transported from other regions can also combine with local emissions to increase local O_3 concentrations. Therefore, the ROI for O_3 may include much of the San Francisco Bay Area Air Basin (SFBAAB).

3.1.1 Regional Conditions

The project alternative sites are located in the SFBAAB. The SFBAAB consists of nine counties: San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Marin, Napa, the southeast portion of Sonoma, and the southwest portion of Solano counties. The SFBAAB covers an area of approximately 5,540 square miles and is shown in Figure 3.1.1-1.

Pollution concentrations in the SFBAAB are generally moderate, due to persistent west to northwest winds that blow off the Pacific Ocean and enhance atmospheric mixing. A discussion of existing conditions of climate, baseline air quality, emission inventories, and applicable air quality regulations follows. The discussion is on a regional basis and generally pertains to all of the project alternative sites.

Table 3.1-1. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards ^(a,c)	National Standards ^(b)	
			Primary ^(c,d)	Secondary ^(c,e)
Ozone (O ₃)	1-Hour	0.09 ppm (180 µg/m ³)	0.12 ppm (235 µg/m ³)	Same as Primary Standard
Carbon Monoxide (CO)	8-Hour	9 ppm (10 mg/m ³)	9 ppm (10 mg/m ³)	-
	1-Hour	20 ppm (23 mg/m ³)	35 ppm (40 mg/m ³)	-
Nitrogen Dioxide (NO ₂)	Annual	-	0.053 ppm (100 µg/m ³)	Same as Primary Standard
	1-Hour	0.25 ppm (470 µg/m ³)	-	-
Sulfur Dioxide (SO ₂)	Annual	-	0.03 ppm (80 µg/m ³)	-
	24-Hour	0.04 ppm (105 µg/m ³)	0.14 ppm (365 µg/m ³)	-
	3-Hour	-	-	0.5 ppm (1,300 µg/m ³)
	1-Hour	0.25 ppm (655 µg/m ³)	-	-
Particulate Matter (PM ₁₀)	Annual	30 µg/m ³ ^(f)	50 µg/m ³ ^(g)	Same as Primary Standard
	24-Hour	50 µg/m ³	150 µg/m ³	-
Sulfates	24-Hour	25 µg/m ³	-	-
Lead	30-Day	25 µg/m ³	-	-
	Quarterly	-	1.5 µg/m ³	Same as Primary Standard
Hydrogen Sulfide	1-Hour	0.03 ppm (42 µg/m ³)	-	-
Vinyl Chloride	24-Hour	0.010 ppm (26 µg/m ³)	-	-
Visibility ^(h)	8-Hour (10 a.m. to 6 p.m.)	In sufficient amount to produce an extinction coefficient of 0.23 per km due to particles when the relative humidity is less than 70 percent. ARB Method V.		-

Table 3.1-1. National and California Ambient Air Quality Standards

Notes:

- a. California standards for ozone, carbon monoxide, sulfur dioxide (1-Hour and 24-Hour), nitrogen dioxide, particulate matter, and visibility reducing particles are values that are not to be exceeded. The sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded.
- b. National standards other than ozone and those based on annual averages or arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with a maximum hourly average concentrations above the standard is equal to or less than one.
- c. Equivalent units given in parathensis are based on reference temperature of 25 °C and a reference pressure of 760 mm of mercury. All measurements of air quality are corrected to a reference temperature of 25 °C and a reference pressure of 760 mm of mercury (1,013.2 millibar); ppm in this table refers to ppm by volume. or micromoles of pollutant per mole of gas.
- d. National Primary Standards: The levels of air quality necessary with an adequate margin of safety to protect the public health.
- e. National Secondary Standards: The levels of air quality necessary protect the public welfare from any known or anticipated adverse effects from a pollutant.
- f. Calculated as geometric mean
- g. Calculated as arithmetic mean
- g. This standrd is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70 percent.

ppm = parts per million

km = kilometer

ARB = Air Resources Board

$\mu\text{g}/\text{m}^3$ = micrograms per cubic meter



Figure 3.1.1-1

SAN FRANCISCO BAY AREA AIR BASIN

3.1.1.1 Climate and Meteorology

The climate of the project area is classified as Mediterranean, characterized by cool, dry summers and mild, wet winters. The major influence on the regional climate is the Eastern Pacific High, a strong persistent anticyclone. Seasonal variations in the position and strength of this system are a key factor in producing weather changes in the area.

The Eastern Pacific High attains its greatest strength and most northerly position during the summer, when it is centered west of Northern California. In this location, the High effectively shelters California from the effects of polar storm systems from the North Pacific. Due to the large-scale atmospheric subsidence associated with the High, an elevated temperature inversion often occurs along the West Coast. The base of this inversion is usually located from 1,000 to 3,000 feet above mean sea level, depending on the intensity of subsidence and the prevailing weather condition. Vertical mixing is often limited to the base of the inversion, trapping air pollutants in the lower atmosphere. Marine air trapped below the base of the inversion is often condensed into fog and stratus clouds by the cool Pacific Ocean. This condition is typical of the warmer months of the year from roughly May through October. Typically, the stratus forms offshore and moves into coastal areas during the evening hours. As the land heats up the following morning, the clouds will burn off to the immediate coastline, then move back onshore the following evening.

As winter approaches, the High begins to weaken and shift to the south, allowing polar storms to pass through the region. These storms produce periods of cloudiness, strong shifting winds, and precipitation. The number of days with precipitation can vary greatly from year to year, resulting in a wide range of annual precipitation totals. Storm conditions are usually followed by periods of clear skies, cool temperatures, and gusty northwest winds as the storm systems move eastward. Precipitation is generally lowest along the coastline and increases inland toward higher, mountainous terrain. Annual precipitation totals for the Oakland International Airport ranged from 9 to 30 inches during a 40-year period of record (1941 through 1980), with an annual average of 17.77 inches (NOAA 1980). About 90 percent of rainfall occurs during the months of November through April.

The average high and low temperatures at the Oakland International Airport in July are 71.1°F and 55.5°F, respectively. January average high and low temperatures are 55.6°F and 40.7°F. Extreme high and low temperatures recorded from 1941 through 1980 were 107.0°F and 23.0°F, respectively (NOAA 1980). Temperatures within the Bay are generally less extreme, due to the moderating effect of the Pacific Ocean.

The proximity of the Eastern Pacific High and a thermal low pressure system in the Central Valley region to the east produces a general west to northwest air flow along the Central and Northern California coast for most of the year. The persistence of these breezes is a major factor in minimizing air quality impacts on almost 6 million people that live in the region. As this flow is channeled through the Golden Gate Bridge, it branches off to the northeast and southeast, once inside the Bay. As a result, winds often blow from the southwest in the Berkeley area and from the northwest in the South Bay. Easterly winds that blow toward the offshore waters also occur, but are mainly nocturnal and wintertime land breezes. These land breezes may extend many miles offshore during the colder months of the year until daytime heating reverses the flow back onshore.

Setting -- Air Quality

During the fall and winter months, the Eastern Pacific High can combine with high pressure over the Great Basin to produce extended periods of light winds and low-level temperature inversions. This condition frequently produces poor atmospheric dispersion that results in degraded regional air quality. Ozone standards traditionally are exceeded when this condition occurs during the warmer months of the year.

3.1.1.2 Baseline Air Quality

The EPA designates all areas of the United States as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. A nonattainment designation means that a primary NAAQS has been exceeded more than three discontinuous times in three years in a given area. Pollutants in an area are often designated as unclassified when there is a lack of data for the EPA to form a basis of attainment status. The SFBAAB is in attainment for NO₂ and SO₂ and in nonattainment for CO, O₃, and PM₁₀. It is also designated as a moderate nonattainment area for both O₃ and CO by the EPA (personal communications, K. Smith 1993).

The ARB designates areas of the state as either in attainment or nonattainment of the CAAQS. An area is in nonattainment if the CAAQS has been exceeded more than once in three years. At the present time, the SFBAAB is in nonattainment of the CAAQS for O₃, CO, and PM₁₀. It is also designated as a serious and moderate nonattainment area for O₃ and CO, respectively, by the ARB. (For an explanation of the nonattainment classification schemes, see section 3.1.1.4.)

Maximum pollutant concentrations measured at various monitoring stations in the vicinity of the Oakland Harbor from 1990 through 1992 are provided in Table 3.1.1.2-1 and characterize the background air quality of the project region (ARB 1991, 1992, and 1993). The Oakland Station, approximately 3 miles east of the Harbor, is the closest station to the project dredging area. Data from the San Francisco and San Rafael stations represent background pollutant conditions at the project alternative sites in the offshore and north Bay areas, respectively. Generally, concentrations of photochemical smog, or O₃, are highest during the summer months and coincide with periods of maximum insolation. Inert pollutant concentrations (those pollutants other than O₃) tend to be the greatest during the winter months when extended periods of light wind conditions and surface-based temperature inversions occur. The following is a discussion of the various pollutants monitored within the SFBAAB.

Ozone

Ozone is a colorless gas that is formed in the atmosphere by the photochemical reactions of ROG and NO_x. Ozone is a respiratory irritant and can cause damage to lung tissue. Sensitive plant species and synthetic materials can also be damaged by O₃ at concentrations as low as 0.02 ppm. The data in Table 3.1.1.2-1 show that the one-hour CAAQS of 0.09 ppm was not exceeded during the 1990 through 1992 period in the project region.

Nitrogen Dioxide

Nitrogen dioxide is a reddish-brown gas with an irritating odor. It is produced by the combustion of fossil fuels, which allow nitrogen and oxygen to combine and form NO. This gas then reacts with oxygen to produce NO₂. Nitrogen dioxide is a respiratory irritant and can cause lung tissue damage. It reacts with ROG to form O₃. The maximum NO₂ concentrations monitored in the project area are

Table 3.1.1.2-1. Maximum Pollutant Concentrations Monitored in the San Francisco Bay Area Air Basin

1990 - 1992

(page 1 of 2)

Pollutant/Monitoring Station	Averaging Time/ Measurement	MAXIMUM CONCENTRATION BY YEAR			NUMBER OF DAYS FEDERAL STANDARDS EXCEEDED			NUMBER OF DAYS STATE STANDARDS EXCEEDED		
		1990	1991	1992	1990	1991	1992	1990	1991	1992
OZONE										
San Rafael	1-hour (ppm)	0.06	0.08	0.07	0	0	0	0	0	0
San Francisco (Ar)		0.06	0.05	0.08	0	0	0	0	0	0
Oakland (Alice)		0.06	0.06	0.08	0	0	0	0	0	0
NITROGEN DIOXIDE										
San Rafael	Annual	0.021	0.022	0.021	0	0	0	NA	NA	NA
San Francisco (Ar)		0.021	0.024	0.022	0	0	0	NA	NA	NA
Richmond - 13th St.		0.020	0.021	0.019	0	0	0	NA	NA	NA
San Rafael	1-hour	0.07	0.09	0.08	NA	NA	NA	0	0	0
San Francisco (Ar)		0.11	0.10	0.09	NA	NA	NA	0	0	0
Richmond - 13th St.		0.08	0.08	0.08	NA	NA	NA	0	0	0
CARBON MONOXIDE										
San Rafael	8-hour	5.0	5.7	5.0	0	0	0	0	0	0
San Francisco (Ellis)		6.9	8.4	7.4	0	0	0	0	0	0
Oakland (Alice)		6.1	6.8	4.6	0	0	0	0	0	0
San Rafael	1-hour	8.0	10.0	8.0	0	0	0	0	0	0
San Francisco (Ellis)		12.0	14.0	10.0	0	0	0	0	0	0
Oakland (Alice)		8.0	9.0	7.0	0	0	0	0	0	0
PM ₁₀										
San Rafael	Annual	22.6	26.4	22.0	NA	NA	NA	0	0	0
San Francisco (Ar)	(geometric)	27.8	29.7	27.6	NA	NA	NA	0	0	0
Richmond - 13th St.	(µg/m³)	23.0	24.4	23.4	NA	NA	NA	0	0	0

Table 3.1.1.2-1. Maximum Pollutant Concentrations Monitored in the San Francisco Bay Area Air Basin
1990 - 1992
 (page 2 of 2)

Pollutant/Monitoring Station	Averaging Time/ Measurement	MAXIMUM CONCENTRATION BY YEAR			NUMBER OF DAYS FEDERAL STANDARDS EXCEEDED			NUMBER OF DAYS STATE STANDARDS EXCEEDED		
		1990	1991	1992	1990	1991	1992	1990	1991	1992
San Rafael	Annual (arithmetic) (µg/m³)	26.0	30.4	24.0	0	0	0	NA	NA	NA
San Francisco		34.0	34.9	31.6	0	0	0	NA	NA	NA
Richmond - 13th St.		26.5	29.1	26.1	0	0	0	NA	NA	NA
San Rafael	24-hour	115	115	63	0	0	0	4	10	5
San Francisco (Ar)		*165	109	81	1	0	0	12	15	9
Richmond - 13th St.		109	97	55	0	0	0	5	9	3
SULFUR DIOXIDE										
Richmond - 13th St.	Annual	0.001	0.001	0.001	0	0	0	NA	NA	NA
San Francisco (Ar)		0.001	0.002	0.002	0	0	0	NA	NA	NA
Richmond - 13th St.	24-hour	0.012	0.011	0.011	0	0	0	0	0	0
San Francisco (Ar)		0.012	0.016	0.013	0	0	0	0	0	0
Richmond - 13th St.	1-hour	0.07	0.03	0.03	NA	NA	NA	0	0	0
San Francisco (Ar)		0.03	0.04	0.04	NA	NA	NA	0	0	0

Note: * Exceeds the NAAQS.

shown in Table 3.1.1.2-1. These data show that the one-hour and annual concentrations were generally less than 50 percent of their applicable standards.

Sulfur Dioxide

Sulfur dioxide is a colorless, nonflammable gas with a pungent odor. SO₂ is a respiratory irritant that is mainly produced from the combustion of sulfur-containing fossil fuels, as a byproduct in refining fossil fuels from crude oil, and from the production of sulfuric acid. The data in Table 3.1.1.2-1 show that all SO₂ concentrations were only a fraction of their applicable standards.

Carbon Monoxide

Carbon monoxide is a clear, odorless gas produced by the incomplete combustion of fossil fuels and organic substances. The natural degradation of plant matter can also contribute to the production of CO, but motor vehicles are by far the largest source. Carbon monoxide is not a respiratory irritant, but rather passes through lungs and interferes with the transfer of oxygen in blood. Symptoms of exposure include dizziness, headache, and in extreme cases, loss of consciousness. Table 3.1.1.2-1 shows that the maximum CO levels monitored in proximity to the project site were less than their applicable standards. The highest ambient CO concentrations usually occur near congested transportation arteries and intersections.

PM₁₀

Particulate matter, less than ten microns in diameter, is produced by a wide range of activities including natural wind erosion, combustion of fossil fuels, mining, and transporting and handling of minerals. This size of particulate matter is of concern because they are small enough to pass through the bronchial passages in the lung and into the alveoli where they can be retained indefinitely. If PM₁₀ contains water soluble compounds, the soluble portion can be absorbed and transported through the blood system to other organs where they can cause damage.

Table 3.1.1.2-1 shows that the maximum PM₁₀ levels monitored in proximity to the project site periodically exceeded the 24-hour CAAQS. The 24-hour NAAQS was also exceeded at the San Francisco station once in 1990. However, annual standards were not exceeded at any of these locations during the monitoring period.

3.1.1.3 San Francisco Bay Area Air Basin Emissions

The total air emissions that occurred in the SFBAAB during 1989 are displayed in Table 3.1.1.3-1. The SFBAAB emissions inventory is periodically updated for planning purposes to forecast future emissions inventories, to analyze individual control measures, and for input data to regional air quality modeling. The 1989 inventory represents the most current emissions data available for the SFBAAB (ARB 1991a). Table 3.1.1.3-1 shows that the largest contributors to air pollutants in the SFBAAB are mobile sources. On-road motor vehicles account for approximately 30 percent of the ROG, 73 percent of the CO, 57 percent of the NO_x, and 25 percent of the SO₂ emitted in the SFBAAB.

**Table 3.1.1.3-1. 1989 Emission Inventory for the San Francisco Bay Area Air Basin
(tons/day)**

	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NO_x</i>	<i>SO_x</i>	<i>PM₁₀</i>
Stationary Sources						
Fuel combustion	43	18	210	140	14	32
Waste burning	0.9	0.7	3.6	3.4	0.3	1
Solvent use	160	150	---	---	---	---
Petroleum process, storage, and transfer	110	62	3.5	11	39	1.9
Industrial processes	11	9.4	27	2.3	7.8	20
Miscellaneous processes	1,000	250	20	0.2	---	460
Subtotal	1,400	490	270	160	61	510
Mobile Sources						
On-road vehicles	260	240	1,900	330	27	30
Ships	1	1.4	0.9	4.9	16	0.7
Other mobile sources	62	59	449	85	6	7.2
Subtotal	320	300	2,300	420	50	38
TOTAL	1,700	790	2,600	580	110	550

Note: TOG = total organic gases.

Source: ARB 1991a. All values reported as rounded in the 1989 Emission Inventory document.

3.1.1.4 Regulatory Setting

Air quality regulations were first promulgated with the Federal Clean Air Act of 1969. This act established the NAAQS and delegated the enforcement of air pollution control to the states. In California, the ARB has been designated as the agency responsible for regulating air pollution sources. The ARB, in turn, has delegated the responsibility of regulating stationary emission sources to local air pollution control or management districts. The following is a summary of the federal, state, and local air quality rules and regulations that apply to project activities.

Federal Statutes and Regulations

Federal Clean Air Act (CAA), 42 U.S.C. 7401 and EPA implementation regulations at 40 Code of Federal Regulations (CFR), Parts 50 and 51. The CAA states that all applicable federal and state ambient air quality standards must be maintained during the operation of any emission source. The NAAQS shown in Table 3.1-1 include both primary and secondary standards for various pollutants. Primary standards are mandated by the CAA to protect the public health, while secondary standards are intended to protect the public welfare from the adverse effects of a pollutant, such as materials soiling, vegetation damage, and visibility impairment. The CAA also delegates to each state the authority to establish their own air quality rules and regulations. In states where the NAAQS are exceeded, the CAA requires preparation of a State Implementation Plan (SIP) that identifies how the state will meet the standards within the time frames mandated by the Clean Air Act Amendments of 1990.

The 1990 CAA requires areas in nonattainment of the NAAQS for O₃ to reduce basinwide VOC emissions by 15 percent for the first 6 years and by an average of 3 percent per year thereafter until

attainment is reached. Control measures must be identified in the SIP that will facilitate the reduction in emissions and show progress toward attainment of the ozone standard. With regard to CO nonattainment areas, a plan must be submitted that identifies ways to reduce CO emissions and shows progress toward attainment. Additionally, the 1990 CAA promulgates new toxic air pollutant standards and identifies affected sources and control measures required to meet these standards.

CAA Amendments of 1990 (1990 CAA) established new nonattainment classifications, new emission control requirements, and new compliance dates for areas presently in nonattainment of the NAAQS, based upon a design day value. The design day value is the fourth highest pollutant concentration recorded in a three-year period. The requirements and compliance dates for reaching attainment are based on the nonattainment classification. The classifications and compliance dates are shown in Table 3.1.1.4-1.

In addition, the 1990 CAA also requires that any federally funded project must comply with the air quality standards and regulations that have been established by federal, state, and local regulatory agencies.

The 1990 CAA requires federal actions to complete an analysis of whether the project would conform to the requirements of the most recent federally approved SIP. Final guidelines on how to perform the conformity analysis were recently promulgated by the EPA (EPA 1993b). Since the environmental analysis for the project was initiated prior to December 30, 1993, the Corps is exempt from these recent guidelines. Nevertheless, to qualify for this exemption, an analysis of project conformity must be completed by March 15, 1994 (personal communications, D. Grano 1994). The project conformity analysis is provided in section 4.1.2.3.

Table 3.1.1.4-1. Federal Attainment Schedule

<u>Pollutant</u>	<u>Classification</u>	<u>Design Day Value Concentration ^a (ppm)</u>	<u>Compliance Date</u>
Ozone	Marginal	0.121-0.138	November 15, 1993
	Moderate	0.138-0.160	November 15, 1996
	Serious	0.160-0.180	November 15, 1999
	Severe	0.180-0.190	November 15, 2005
	Severe	0.190-0.280	November 15, 2007
	Extreme	> 0.280	November 15, 2010
Carbon monoxide	Moderate	9.1-16.4	December 31, 1995
	Serious	> 16.4	December 31, 2000
PM ₁₀	Moderate	---	December 31, 1994
	Serious	---	December 31, 2001

Note: a. The design day value is the fourth highest pollutant concentration recorded in a 3-year period.

Source: Clean Air Act Amendments, November 1990.

Setting – Air Quality

STATE REGULATIONS

California Clean Air Act of 1988 (CCAA), Health & Safety Code 40918-40920. The CCAA requires areas in nonattainment of the O₃ and CO CAAQS to adopt a plan that will lead to the attainment of these standards by the earliest practical date. However, areas in nonattainment for PM₁₀, sulfates, lead, hydrogen sulfide, or visibility are not expressly required to develop an attainment plan under the CCAA. Since the SFBAAB is presently in nonattainment of the CAAQS for O₃ and CO, the Bay Area Air Quality Management District (BAAQMD) is required to reduce emissions of these pollutants by 5 percent annually from the 1987 SFBAAB emission inventory, starting in 1988, or by 15 percent averaged over a 3-year period beginning in 1988. Annual emission reductions of 5 percent thereafter are required, until the CAAQS are attained. Exceptions to this 5 percent annual reduction rule are allowed only if the attainment plan contains all feasible measures to control emissions. The state nonattainment rating system is shown in Table 3.1.1.4-2. Similar to the federal system, the system is based upon the design day concentration.

Table 3.1.1.4-2. State Ozone Nonattainment Classifications

	<u>Classification</u>	<u>Design Day Concentration</u> ¹
<u>Ozone</u>	Moderate	0.09-0.12 ppm, inclusive
	Serious	0.13-0.15 ppm, inclusive
	Severe	0.16-0.20 ppm, inclusive
	Extreme	Greater than 0.20 ppm
<u>Carbon monoxide</u>	Moderate	0.09-0.12 ppm, inclusive
	Serious	0.13-0.15 ppm, inclusive

Note: 1. O₃ data based on 1989-1991 calendar years, without regard to transport contributions. CO data based on 1989-1990 and 1990-1991 winter seasons.

Source: California Health and Safety Code Sec. 40918-40920.

Local Regulations

BAAQMD RULES AND REGULATIONS

The CAA gives state and local agencies the authority to establish air quality rules and regulations. Rules adopted by the local air pollution control districts and accepted by the ARB are included in the SIP. When approved by the EPA, these rules become federally enforceable. The BAAQMD, having received the necessary approvals, regulates stationary sources of air pollution in the SFBAAB. The pertinent BAAQMD rules and regulations that apply to project emission sources are summarized below (BAAQMD 1992b):

- Rule 1-301 - Public Nuisance. This rule states that no person shall discharge from any source air contaminants which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or public, or which endangers the comfort, repose,

health or safety of any such persons or public, or which causes, or has a tendency to cause, injury or damage to business or property.

- Regulation 2 defines the review process of sources that require air permits. This regulation sets forth preconstruction requirements for stationary sources that may include Best Available Control Technology (BACT) and emission offsets. Additionally, Rule 2-1-310.3 states that the air pollution control officer shall not authorize the installation or operation of any new source that is subject to the requirements of CEQA, until all CEQA requirements are satisfied.
- Regulation 6 identifies standards that limit particulate matter emissions and the visibility and opacity of effluent from all sources.
- Regulation 7 identifies limitations on odorous substances and specific emission limitations on certain odorous compounds.
- Rule 9-1-304 states that a person shall not burn any liquid fuel having a sulfur content in excess of 0.5 percent by weight. However, this rule exempts fuel used to propel any motor vehicle, boat, or ship. As a result, the sulfur limitation would only apply to project construction machinery and dredges.

For the purpose of evaluating air quality impacts from proposed projects, the following emission thresholds are used by the BAAQMD to determine the significance of proposed emissions: 150 pounds per day TOG, NO_x, SO₂, and PM, and 550 pounds per day of CO (personal communication, J. Walser 1993).

CLEAN AIR PLAN

In conformance with the CCAA, the BAAQMD, in cooperation with the Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC), developed the *1991 Bay Area Clean Air Plan* (CAP), to bring the SFBAAB into attainment of the O₃ and CO CAAQS (BAAQMD 1991b). Progress toward attainment is demonstrated in the CAP through the implementation of control measures and their resulting decrease in future SFBAAB emission inventories. The CAP demonstrates attainment of the CO standard by about 1995 and the federal O₃ standard before 1997. However, the CAP cannot demonstrate attainment of the state O₃ standard by 1997. Application of all feasible control measures outlined in the CAP would reduce basinwide emissions of CO, ROG, and NO_x by 4.0, 4.0, and 2.6 percent, respectively, during the 1987 through 1994 planning period. These emission reductions would be tracked through an emissions inventory system that facilitates analysis and progress reporting.

The BAAQMD also developed two plans to conform with the 1990 CAA requirements of a 15 percent reduction in basinwide VOC emissions between 1990 and 1996: the *Redesignation Request and Maintenance Plan for the National O₃ Standard* (Maintenance Plan) and the *Nonattainment Area and Rate of Progress Plan for the National O₃ Standard* (Attainment Plan) (AQMD, ABAG, and MTC 1993). Since the SFBAAB has not exceeded the national O₃ standard more than once annually for the last three years, the BAAQMD believes the region is in attainment of this standard. The Maintenance Plan demonstrates continued attainment of the national O₃ standard in the SFBAAB. Both Plans have been

submitted to the EPA. If the EPA approves the Maintenance Plan, the Attainment Plan will be withdrawn. The Attainment Plan demonstrates attainment of the national O₃ standard by 1996.

Emission control measures proposed in the CAP/Maintenance Plan/Attainment Plan (Plans) include indirect and area source control programs, application of Best Available Retrofit Control Technology (BARCT) to existing stationary sources, a modification of the permitting program to achieve no net increase of emission from new or modified stationary sources, consideration of transportation control measures that will reduce vehicle miles travelled, and significant use of low-emission motor vehicles by operators of motor vehicle fleets. A determination of project conformity with the Plans is required to evaluate if the proposed action would interfere with the attainment strategy outlined in the Plans. A proposed action generally would conform with the Plans if project emissions are included in future Plans emission inventories.

3.1.1.5 Sensitive Receptors

The impact of emissions to the most sensitive members of the population is a special concern. Sensitive receptor groups include children, elderly, and the acutely and chronically ill. The locations of these groups include residences, schools, day care centers, and hospitals. Therefore, a new project should ensure that its emissions do not cause a nuisance to sensitive receptors in proximity to the project.

3.2 HYDROLOGY, GROUNDWATER, AND WATER QUALITY

3.2.1 Regulatory Standards

Regulatory standards for water quality in the San Francisco Bay and Delta Estuary region are promulgated by a number of agencies under various legislation. The EPA establishes federal criteria for drinking water quality as mandated by the *Safe Drinking Water Act* (as amended in 1987) and for freshwater and saltwater aquatic life water quality as mandated by the *Water Pollution Control Act* (*Clean Water Act*).

Under provisions of the State Porter-Cologne Water Quality Control Act and the Clean Water Act (CWA), the San Francisco Bay Regional Water Quality Control Board (SF-RWQCB) and the Central Valley Regional Water Quality Control Board (CV-RWQCB) (as regional offices of the State Water Resource Control Board [SWRCB]), regulate water quality in the San Francisco Bay and Delta Estuary region. The SF-RWQCB regulates water quality in the watershed of San Francisco Bay downstream of Sherman Island, and the CV-RWQCB regulates water quality in the Delta and Central Valley, upstream of Sherman Island. The regional boards are authorized to monitor surface and groundwater quality and to require permits for the discharge of wastewater to all navigable waters.

In 1975, the SWRCB approved the "Basin Plan" for the Sacramento River, Sacramento-San Joaquin Delta, San Joaquin River, and Tulare Lake basins, followed in 1978 (and amended in 1992) by an adopted water quality control plan for the Delta. In 1993, the SWRCB adopted amendments to the 1986 water quality control plan for the San Francisco Bay Basin Region. These plans contain water quality standards for the Delta and San Francisco Bay that conform to the SWRCB policies for water quality control. Three of these policies are of particular importance to the proposed project. They include the following:

1. SWRCB Resolution Number 68-16, which establishes a Non-Degradation Policy with respect to maintaining the high quality of waters in California. Under this resolution, it is SWRCB policy that whenever the existing quality of the water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated that any degradation to quality will result in a significant public benefit. In addition, any activity that produces a waste or increases volume or concentration of waste and that discharges or proposes to discharge to existing high quality water will be required to meet waste discharge and water quality requirements.
2. In 1974 the SWRCB adopted the "Water Quality Control Policy for the Enclosed Bays and Estuaries of California" under SWRCB Resolution Number 74-43. The purpose of this policy is to prevent water quality degradation and to protect the beneficial uses of bays and estuaries in California by establishing water quality principles, effluent quality requirements, and prohibitions governing the disposal of wastes into these waters. The Board determined that the discharge of municipal wastewaters and industrial process waters (exclusive of cooling water discharges) shall be phased out at the earliest practicable date. Exceptions to this provision are only allowed if the board finds that the wastewater in question would consistently be treated and discharged in such a manner

that it would enhance the quality of the receiving waters above that which would occur in the absence of the discharge.

3. In Resolution Number 88-63 "Sources of Drinking Water," the SWRCB established a state policy that all surface and groundwaters of the state are considered suitable or potentially suitable for municipal or domestic water supply with the exception of those waters that are hydrologically, biologically, economically, or practicably unsuitable for public use. Specifically exempted are surface and groundwaters where (1) the total dissolved solids exceed 3,000 mg/l and are not reasonably expected by Regional Boards to supply a public water system; or (2) there is contamination either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices (BMP) or best economically achievable treatment practices; or (3) the water source does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day. Surface waters are excepted where the water is in systems that collect or treat municipal or industrial wastewaters, process waters, mining wastewaters, or stormwater runoff, provided that the discharge from such systems is monitored to ensure compliance with water quality objectives. Water in systems designed or modified for the primary purpose of conveying or holding agricultural drainage waters is excepted, provided that the discharge is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards.

In 1987, the SWRCB began proceedings (the Bay-Delta Hearings) to develop and implement water quality objectives needed to protect the beneficial uses of Bay-Delta waters. The primary products of this hearing process are two documents: the Pollutant Policy Document (PPD) (SWRCB 1990b) and the Revised Draft Water Quality Control Plan for Salinity for the San Francisco Bay and Sacramento-San Joaquin Delta Estuary (SWRCB 1990c). The PPD has been adopted as of June 21, 1990 and establishes state policy for water quality control under Water Code sections 13140-13147 to be used by the CV-RWQCB and SF-RWQCB in updating portions of their Basin Plans. Pollutants with the greatest potential biological significance in the San Francisco Bay Estuary are also identified and characterized in the PPD.

The SWRCB adopted statewide water quality control plans for Inland Surface Waters and Enclosed Bays and Estuaries in April 1991. The plans include guidelines for pollutants for which EPA or the state have developed criteria and that can reasonably be expected to impact beneficial uses. For each pollutant, numerical water quality objectives based on EPA 304(a) criteria are established for the protection of human health or aquatic life. Acute and chronic toxicity objectives and narrative objectives are also established. These plans supplement the Basin Plans for the SF-RWQCB and CV-RWQCB regions.

When considering these regulatory standards, if this proposed project is permitted, the placement of the harbor sediment at upland sites could be considered a discharge of waste to land. If this is the case, the SF-RWQCB or CV-RWQCB (depending on the location of the disposal site) would implement the regulations governing this project (Title 23 CAC Chapter 3, Subchapter 15).

3.2.1.1 Drinking Water Standards

Drinking water standards are established by both state and federal agencies. Based on guidelines developed by the EPA and California Department of Health Services (DOHS), primary and secondary

drinking water standards are established that must be met by public water systems. Federal standards are established pursuant to the Public Health Service Act, as amended by the Safe Drinking Water Act and other federal regulations relating to public water systems. As defined by the federal regulations (40 CFR 141):

The "maximum contaminant level" (MCL) means the maximum permissible level of a contaminant in water that is delivered to the free flowing outlets of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system.

Under the National Interim Primary Drinking Water Regulations promulgated by EPA (40 CFR parts 141 and 143), MCLs have been developed for a number of microbiological, inorganic chemicals, organic chemicals, and radionuclide contaminants. State MCLs are listed in Table 3.2.1.1-1. The state MCLs are detailed in Title 22 CAC Chapter 15, Article 4.

In addition to the MCLs, water quality objectives for domestic or municipal supplies are designated in the SF-RWQCB and CV-RWQCB Basin Plans. Such waters must not contain concentrations of chemicals in exceedance to those specific in Title 22 CAC, Chapter 15, Article 4. Water quality objectives for domestic or municipal supplies in the SF-RWQCB and CV-RWQCB Basin Plans are listed in Table 3.2.1.1-1.

3.2.1.2 Proposition 65

The Safe Drinking Water and Toxic Enforcement Act of 1986 was approved by California voters as Proposition 65 in November 1986. Its purpose is to prohibit the discharge, into sources of drinking water, of chemicals that have been listed by the Governor as causing cancer or reproductive toxicity. Twelve months after the listing of a chemical by the Governor and the Scientific Advisory Panel appointed by the Governor, that chemical still can be discharged only if those people who may be exposed have been notified. However, Proposition 65 may not apply to a discharge that does not contribute a "significant concentration" of a chemical, according to a concentration level that is determined by the Health and Welfare Agency. The agency has issued No-Significant-Risk Levels (NSRLs) for numerous chemicals, below which there is no assumed significant risk of cancer or reproductive toxicity. NSRLs are regulatory limits in micrograms/day that assume a daily exposure to the chemical. Quantitative risk assessments, which evaluate all potential pathways and assume lifetime exposures, are used to determine the level of exposure to a chemical.

3.2.1.3 EPA Ambient Water Quality Standards

Water quality criteria (WQC) were developed by EPA to protect approximately 95 percent of the organisms in the aquatic environment based upon acute, chronic, and bioaccumulative testing to species at different trophic levels (EPA 1986). The criteria were developed from comprehensive species-specific acute, chronic, and bioaccumulation databases. These databases were derived from laboratory studies primarily with estuarine species and single contaminants. WQC do not address multiple contaminant interactions, the form of the contaminant, or the potential sensitivity differences between estuarine and oceanic species. Criteria are used as toxicological estimates for aquatic chemical concentrations that are protective of marine life. These criteria are listed in Table 3.2.1.3-1.

Table 3.2.1.1-1. State Water Quality Standards

<i>Parameter</i>	<i>SF-RWQCB Basin Plan Objectives - Marine (µg/L)</i>	<i>SF-RWQCB Basin Plan Objectives for Municipal Supply Waters (µg/L)</i>	<i>Revised Draft Water Quality Control Plan for Salinity (mmho/cm)</i>	<i>Drinking Water Primary MCL (µg/L)</i>	<i>Drinking Water Secondary MCL (µg/L)</i>
Arsenic	36 ⁽¹⁾ ; 69 ⁽²⁾	50	--	50	--
Barium	--	1,000	--	1,000	--
Beryllium	--	--	--	--	--
Cadmium	9.3 ⁽¹⁾ ; 43 ⁽²⁾	10	--	10	--
Chromium (total)	--	50	--	50	--
Chromium VI	50 ⁽¹⁾ ; 1,100 ⁽²⁾	--	--	--	--
Copper	2.9 ⁽²⁾	1,000	--	--	--
Lead	5.6 ⁽¹⁾ ; 140 ⁽²⁾	50	--	50	--
Mercury	0.025 ⁽¹⁾ ; 2.1 ⁽²⁾	2	--	2	--
Nickel	8.3 ⁽¹⁾ ; 75 ⁽²⁾	--	--	--	--
Selenium	7.1 ⁽³⁾ ; 300 ⁽²⁾	10	--	10	--
Silver	2.3 ⁽⁴⁾	50	--	50	--
Tributyltin	0.005 ⁽⁶⁾	--	--	--	--
Zinc	86 ⁽¹⁾ ; 95 ⁽²⁾	5,000	--	--	--
Aluminum	--	--	--	--	1,000
Iron	--	300	--	--	--
Manganese	--	50	--	--	--
Cyanide	5.0 ⁽²⁾	10	--	--	--
TDS	--	500,000	--	--	--
Chloride	--	250,000	150-250 ⁽⁵⁾	--	--
Fluoride	--	800-1,700	--	1,400-2,400 td	--
Nitrate	--	--	--	45,000 (as NO ₃)	--
pH (unitless)	--	6.0-8.5	--	--	--
EC (mmho/cm)	--	0.9	0.45-19.0 ⁽⁵⁾	--	--
Total PAHs	15 ⁽⁶⁾	--	--	--	--

Notes:

- 1. = 4-day average
- 2. = 1-hour average
- 3. = 24-hour average
- 4. = instantaneous maximum
- 5. = variable depending on the resource and location
- 6. = 30-day average
- td = temperature dependent value
- MCL = maximum contaminant level

Table 3.2.1.3-1. Federal EPA Ambient Water Quality Standards and Criteria
(page 1 of 2)

<i>Parameter</i>	<i>EPA Ambient Water Quality Criteria- Freshwater Chronic (µg/L)</i>	<i>EPA Ambient Water Quality Criteria- Freshwater Acute (µg/L)</i>	<i>EPA Ambient Water Quality Criteria- Marine Chronic (µg/L)</i>	<i>EPA Ambient Water Quality Criteria- Marine Acute (µg/L)</i>
Antimony	1,600 ¹	9,000 ²	--	--
Arsenic	190 ¹	360 ²	36 ¹	69 ²
Barium	--	--	--	--
Beryllium	--	5.3 ¹⁰	130 ¹⁰	--
Cadmium	1.1 ¹	3.9 ²	9.3 ¹	43 ²
Chromium (total)	210 ¹	1,700 ²	--	--
Chromium VI	11 ¹	16 ²	50 ¹	1,100 ²
Copper	12 ¹	18 ²	--	2.9 ²
Lead	3.2 ¹	82 ²	5.6 ¹	140 ²
Mercury	0.012 ¹	2.4 ²	0.025 ¹	2.1 ²
Nickel	158 ³	1,418 ⁴	8.3 ³	75 ⁴
Selenium	--	5 ^{3,8}	20 ^{4,8}	54 ³ , 410 ⁴
Silver	--	4.1 ⁴	--	--
Thallium	--	40 ¹⁰	1,400 ¹⁰	213 ¹⁰
Tributyltin	--	26 ⁹	--	10 ⁹
Zinc	110 ¹	120 ²	86 ¹	95 ²
Aluminum	87 ¹	750 ²	--	--
Iron	--	1,000 ⁴	--	--
Manganese	--	--	--	--
Ammonia as N	Ratio ⁵	Ratio ⁶	--	--
Alkalinity as CaCO ₃	--	20,000 ⁷	--	--
Cyanide	5.2 ¹	22 ²	--	1.0 ²
Sulfide-Hydrogen Sulfide	2.0	--	2.0	--
Total Dissolved Solids	--	--	--	--
Chloride	--	--	--	--
Fluoride	--	--	--	--
Nitrate	--	--	--	--
Nitrite	--	--	--	--
Sulfate	--	--	--	--
Specific Conductivity	--	--	--	--
Polyaromatic Hydrocarbons	--	300 ¹⁰	--	--
Carbon Tetrachloride	--	35,000 ¹⁰	--	50,000 ¹⁰

The State of California has proposed adopting EPA water quality criteria as state standards. This adoption action is not yet complete, in part due to litigation. By complying with these criteria, water quality objectives of the Basin Plan for toxic pollutants have been achieved (see section 3.2.1.5).

3.2.1.4 Standards for Agricultural Supply

The SF-RWQCB and CV-RWQCB Basin Plans provide water quality standards for waters designated for use as agricultural supply. Concentrations of chemicals may not be at levels that adversely affect this beneficial use. These standards are listed in Table 3.2.1.1-1.

3.2.1.5 Basin Plan Objectives

The Water Quality Control Plan provides the basis for California water quality control management and, consequently, the protection of California's waters. The plan defines (a) beneficial water uses that the state will protect, (b) water quality objectives intended to protect the beneficial uses, and (c) strategies for implementation of the plan. Beneficial uses for surface waters range from scenic beauty to the perpetuation of aquatic life. The primary objective of the Basin Plan is to control concentrations of pollutant constituents in water masses to adequately protect beneficial water uses (RWQCB 1986).

The Basin Plan defines surface water quality objectives for several parameters, including suspended material, turbidity, pH, dissolved oxygen, bacteria, temperature, salinity, toxicity, ammonia, and sulfides. Dredging and material disposal in San Francisco Bay is of considerable concern to the RWQCB because these activities are ongoing and, based on several studies, have demonstrated localized and ephemeral impacts to water quality and, hence, aquatic life. Parameters of concern specific to dredging and material disposal are habitat disruption, total suspended solids loading, reduction of dissolved oxygen, mobilization of toxic pollutants, and the release of nutrients. The RWQCB has established effluent limitations to help achieve water quality objectives. The Basin Plan Objectives are summarized in Table 3.2.1.5-1.

3.2.2 Regional Bay and Delta Water Quality

The San Francisco Bay estuary is a complex, dynamic water system composed of interconnected embayments, sloughs, marshes, and channels. The ocean, river, and waste waters that mix in this system vary depending on location and season. Conomos (1979) divides the estuary into the Delta (i.e., the mouth of the Sacramento and San Joaquin rivers) and the Bay, composed of the northern and southern reaches. These two reaches display vastly different circulation and sedimentation patterns based on prevailing hydrodynamic conditions. Circulation, in general, is affected by tides entering the Bay from the Pacific, local winds, basin bathymetry, and the local salinity field (USGS 1984). The northern reach receives the majority of fresh water input (>90 percent), while South Bay receives less than 10 percent of the fresh water budget (O'Connor 1991). South Bay receives the majority (>75 percent) of waste water discharged in the Bay, and during the summer, sewage discharge exceeds fresh water in-flow in this area.

Density-salinity driven currents in the northern reach show ebb dominance of the surface water (4 cm/sec) and flood dominance of the bottom water (5 cm/sec). South Bay waters are influenced by Delta outflow during the winter months when low-salinity water moves southward into the southern reach displacing the saline, denser water northward. In the summer months, however, South Bay currents are largely influenced by wind stress on the surface; northwest winds transport water in the direction of the wind,

Table 3.2.1.5-1. Surface Water Quality Objectives for Inland Surface Waters, including Enclosed Bays and Estuaries of the Region

<i>Parameter</i>	<i>Water Quality Objective</i>	<i>Conditions</i>
suspended solids	do not adversely affect beneficial uses	--
pH	6.5 - 8.5, do not cause changes > 0.5 units	standard pH range within Basin
dissolved oxygen (tidal waters)	5.0 mg/L minimum	downstream of Carquinez Bridge
bacteria	see RWQCB 1986	depends on beneficial use
temperature	do not increase by more than 5°F	(a)
salinity	do not adversely affect beneficial uses	especially fish and estuarine habitat
toxicity	bioassays and compliance with EPA water quality criteria	site-specific objectives are needed in some areas
nutrients	• do not exceed 50 µg/L • do not exceed 25 µg/L (if exceeded, further study required)	• upstream from Carquinez Bridge • downstream from Carquinez Bridge
ammonia	• do not exceed 0.16 mg/L as N • do not exceed 0.4 mg/L as N	• Central Bay and upstream • Lower Bay and South Bay
sulfides	follow dissolved oxygen objectives	--
turbidity	no increase above 10 percent of background	--

Note: (a) See Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California.

Source: RWQCB 1991.

and the displaced water causes subsurface currents to flow in the opposite direction (i.e., northward) (Conomos 1979). (See section 3.2.4.3 for a discussion on South Bay hydrodynamics.) In each embayment, narrow, deep shipping channels (10 to 20 m deep) are bordered by expansive shoaling areas. Currents with the highest velocities occur in these channels; low velocity currents move over the shoals, where sedimentation occurs (USGS 1984).

Tidal currents in San Francisco Bay consist of semidiurnal and diurnal partial tides (USGS 1984). Two high tides and two low tides occur daily, with unequal amplitudes (COE 1990). The bay-wide tidal prism is large, representing 24 percent of the Bay volume, given the low average water depth of the Bay (6.1 m) (Conomos 1979; Conomos et al. 1985).

The literature cited in this document often refer to Central Bay as being a distinct sub-unit of the Bay's geography. Central Bay is most strongly influenced by tidal currents due to its close proximity to the Pacific Ocean. The range in water quality parameters fluctuates the least due to the "buffering capacity" of cold, ocean waters (COE 1976 Appendix C). Bay-wide background levels of standard estuarine water quality parameters are provided in Table 3.2.2-1. The data were adapted from the Corps (COE 1976 Appendix C) and were collected during university- and federally-sponsored surveys from 1960 to 1964 and from 1970 to 1975. Nutrients levels were provided in Conomos et al. (1985) and are also shown in Table 3.2.2-1. More recent water quality data are provided, when available, in the sections of the document that follow.

A Pollutant Policy Document (PPD), prepared by the State Water Resources Control Board in 1990, identifies and characterizes pollutants of concern in the Bay and the Sacramento-San Joaquin Delta Estuary. The pollutants of concern were identified based on their widespread occurrence or frequency of occurrence and their potential to cause adverse impacts on beneficial uses. These pollutants are arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, zinc, tributyltin (TBT), organochlorines, chlorinated dibenzodioxins and dibenzofurans, and hydrocarbons. Five sources have been identified in the PPD, including point sources, urban runoff, nonurban runoff, riverine sources, and others. It is estimated that urban runoff may contribute the greatest pollutant loads to the Bay-Delta Estuary. Nonurban runoff (e.g., agricultural lands) and riverine sources also contribute substantial pollutant loads to the Bay-Estuary. Some contaminants levels are very site-specific based on local municipal and industrial discharges (PPD 1990).

Concentrations of metals and organics in Bay Waters, when available, are provided in Table 3.2.2-2. These data were compiled from Appendix A of the PPD along with a review of parameter-specific toxicity to aquatic biota. Some of the parameters listed below generally occur at moderate concentrations in Bay Waters and tissue samples and were determined by the PPD not to be a public health concern. These parameters include chromium, copper, lead, nickel, silver, and zinc. Other parameters, such as arsenic and PAHs, have been measured at moderate to high levels and require further investigation to assess their risks to public health. Cadmium, mercury, selenium, tributyltin, dioxins and furans, and PCBs are of serious concern in Bay Waters because these parameters were found to strongly bioaccumulate in aquatic organisms. DDT levels are apparently stable in the Bay, with severe contamination limited to local areas, such as Lauritzen Canal.

Table 3.2.2-1. Standard Water Quality Data for San Francisco Bay*

<i>Parameter</i>		<i>South Bay</i>	<i>Central Bay</i>	<i>NORTH BAY</i>	
				<i>San Pablo Bay</i>	<i>Suisun Bay</i>
Salinity (ppt)	mean (1960s)	26.2	28.9	18.1	4.2
	mean (1970s)	23.7	24.5	11.5	ND
Temperature (°C)	mean (1960s)	15.5	13.8	14.9	15.0
	mean (1970s)	14.5	14.4	14.4	16.6
Dissolved Oxygen (mg/L)	mean (1960s)	6.3	7.3	8.0	8.4
	mean (1970s)	7.9	7.9	8.6	9.4
pH	mean (1960s)	7.8	7.9	7.7	7.7
	mean (1970s)	7.7	7.7	7.7	7.7
Suspended Solids (mg/L)	mean (1960s)	42	18	45	65
	mean (1970s)	ND	36	77	82
Nutrients (ranges are median values, µg-Atoms/L)	. silicate	70-150	35-75	50-210	120-265
	. phosphate	4-38	2-4	3-4	2.5-3
	. nitrate+ nitrite	15-80	12-20	10-20	7-22
	. ammonia	5-75	4-5	4-6	2-4

Note: * Includes range of values measured throughout the year.

ND = No Data

Source: COE 1976 Appendix C.

Table 3.2.2-2. Concentrations of Metals and Organics in San Francisco Bay Waters
(all values in ppb; from PPD 1990)

<i>Parameter</i>	<i>San Pablo Bay</i>	<i>Central Bay</i>	<i>South Bay</i>
Arsenic	ND	ND	ND
Cadmium	ND	ND	0.1-0.25
Chromium	ND	ND	6-55
Copper	ND	0.5-4.0	2.5-4.0
Lead	ND	0.18-0.033	To 200
Mercury (tl./diss.)	0.009-0.028/ 0.006-0.011	ND/ND	ND/ND
Nickel	ND	1.0 (mean)	8.0 (max.)
Selenium	ND	150-320	ND
Silver	ND	0.004-0.310	0.042 (mean)
Zinc	ND	0.4-2.0	ND
Tributyltin	0.002 ¹	0.006 ²	0.082 ³
PCBs	ND	ND	ND
DDTs	ND	ND	ND
Dioxins and Furans	ND	ND	ND
MAHs	ND	<0.5	ND
PAHs	ND	ND	ND

Notes:

ND = No Data

1. Water sample collected at Mare Island

2. Water sample collected at Pier 39 in San Francisco

3. Water samples collected at marinas in Oakland and Alameda

Seasonal variations in wind, ocean conditions, and water-inflow greatly affect water quality parameters in San Francisco Bay and are well documented (Conomos 1979; COE 1976 Appendix C; Krone 1979; O'Connor 1991; COE 1990; USGS 1984; Rubin and McCulloch 1979; OBAI 1991; SAIC 1992a-d, SAIC 1993a). River in-flow controls water quality parameters in the winter and spring months while wind effects dominate in the summer months. North Bay, which is influenced by fresh water in-flow from the Delta, is typified by oxygenated, low-salinity waters high in suspended solids. Central Bay is characterized by cold, saline waters that are low in total suspended sediment, caused by the intrusion of Pacific waters through the Golden Gate. The highest levels of phosphate, nitrate+nitrite, and ammonia occur in South Bay where the supply of these nutrients appears to be greater than the rate of removal by algae (Conomos et al. 1985).

In all parts of the Bay, water temperature is lowest from January to March and highest in the summer and early fall. Temperature is highest in July for most of the Bay, although a temperature maximum in Central Bay occurs one month later in August. Dissolved oxygen, total suspended solids, and nutrients levels also tend to vary with biological activity. Dissolved oxygen is lowest in summer when waters are relatively quiescent and warm and biological oxygen demand is high. Total suspended solids in Central Bay and the northern reach reaches a maximum in late May and June when runoff is at its peak. However, the influence of Delta outflow is not felt in South Bay until March. Suspended solids increase again in late fall due to wind-wave resuspension. In the north reach, levels of silicates and nitrate + nitrite

are generally higher in the winter months than in summer, coinciding with the Delta outflow. Ammonia and phosphate present in sewage effluents are relatively constant throughout the year in the northern reach. In South Bay, however, silicate and phosphate concentrations are higher in summer than in winter, and nitrate + nitrite and ammonia concentrations are greater in winter than in summer. The supply of nitrate + nitrite and ammonia by local streams in the winter months exceeds the removal rate by algae. Phosphorus is removed from the system during the winter months when low-phosphorus waters from the Delta enters South Bay and flushes it toward the Gate (Conomos et al. 1985).

3.2.3 Oakland Harbor

Hydrodynamics

Oakland Harbor is located in the central, eastern portion of San Francisco Bay at the confluence of the northern reach of the Bay and South Bay. The general hydrodynamics for these areas and Central Bay have been discussed in section 3.2.2.

The Oakland Harbor dredging sites are located in both Inner and Outer Harbor areas. The Oakland Outer Harbor is influenced by hydrodynamic conditions typical of Central Bay. In the Inner Harbor, current and wave patterns are largely generated by tides interacting with bottom and shoreline configurations. Scale model test results of maximum current speeds in the Inner Harbor indicated current speeds of up to 1.3 knots were possible during maximum flood or ebb (Huval 1993). Current measurements and modeling predictions made by the Corps (COE 1990) in Central Bay indicated that net tidal fluxes in the vicinity of the Outer Harbor of Oakland were south along the east side of the Bay and that northward moving currents occurred on the west side of the entrance to South Bay. In the area of Middle Harbor and the entrance to Inner Harbor (south of the peninsular Seventh Street Terminal), currents move in a counterclockwise eddy.

Water Quality

There are limited data available describing existing water quality conditions in Oakland Harbor. The data used to characterize the proposed dredging site in this section are from studies performed regionally, especially those conducted in the Central portion of San Francisco Bay, and from the *Oakland Outer Harbor Environmental Statement, Deep Draft Navigation Improvements* (COE 1979). General hydrodynamic and current water quality conditions can be inferred for the Oakland area based on these data. Because the Oakland Harbor dredging site is located in an urban and industrial area, water quality conditions likely fluctuate with changing storm sewer releases and local industrial discharges. These effects are compounded by seasonal and diurnal temperatures and seasonal fresh water in-flow fluctuations that are observed in the open Bay.

The Inner portions of Oakland Harbor themselves likely experience decreased salinities, increased temperatures, and slightly depressed dissolved oxygen levels relative to the open bay due to the lack of circulation caused by the confines of channel. The Outer Harbor is open to the west and experiences water quality conditions consistent with those in the Central Bay.

Comprehensive hydrologic surveys were conducted from 1960 to 1964 and from 1970 to 1975 to characterize water quality conditions in San Francisco Bay (see section 3.2.2). The results of these studies along with more recent data from Central Bay are shown in Table 3.2.3-1. It is important to note

that the parameters reported by the Corps (COE 1976, Appendix C) were averaged over several years and do not show variability that may occur at specific times of the year. Recently, numerous total suspended solids and turbidity surveys have been performed to characterize water in the vicinity of the Alcatraz disposal site. The results of these studies have been summarized in O'Connor (1991).

Table 3.2.3-1. Central Bay Mean Conventional Water Quality Data

<i>Parameter</i>	<i>1960-1964¹</i>	<i>1970-1975²</i>	<i>1988³</i>	<i>1979-1990⁴</i>
Salinity (ppt)	28.9	24.5	32.5	ND
Temperature (°C)	13.8	14.4	ND	ND
Dissolved Oxygen (mg/l)	7.3	7.9	ND	ND
pH (std. units)	7.9	7.7	ND	ND
Suspended Solids (mg/l)	18	36	20	19.5

Notes:

1. From the University of California, Berkeley Sanitary Engineering Research Laboratory (data average over 5 years). From COE (1976).
2. From Stanford Research Institute and the Environmental Protection Agency (data average over 6 years). From COE (1976).
3. From COE (1990) (Summer Study).
4. O'Connor 1991 (Suspended Solids - Winzler and Kelly 1985).

ND = No Data

Temperature

Central Bay water temperatures are moderated by the entry of Pacific Ocean waters through the Golden Gate. Water temperature at the Golden Gate varies 5°C annually. An average temperature of 14°C was observed in Central Bay from 1960 to 1975 (see Table 3.2.3-1), which is comparable to temperatures observed in Pacific Ocean waters (12.5 to 14°C) (Conomos 1979).

Dissolved Oxygen

A mean dissolved oxygen concentration of 7.6 mg/l was reported for Central Bay waters from 1960 to 1975 (see Table 3.2.3-1). This concentration of dissolved oxygen is well above the minimum ambient dissolved oxygen concentration of 5 mg/l established by the SF-RWQCB (RWQCB 1986).

pH

The average hydrogen ion concentration, or pH, was measured at 7.9 and 7.7 during the two water quality studies shown in Table 3.2.3-1. In these studies, pH was typically uniform throughout the water column although, in some instances, pH increased with depth. The pH likely decreased in surface waters due to increased utilization of carbon dioxide by phytoplankton. The pH values reported in these studies also represent typical concentrations found in seawater: 7.5 to 8.4 (Sverdrup et al. 1964). Bottom water samples collected in 1975 from locations in Oakland Outer Harbor measured from 7.5 to 7.8 (COE 1979). Because pH is affected by changes in temperature, salinity, alkalinity, and biological processes (i.e., photosynthesis, mineralization, and respiration), measurements of pH are expected to vary seasonally in Oakland Harbor.

Salinity

Central Bay water salinities are some of the highest measured in the estuary. An average value of 27 parts per thousand (ppt) was measured during the studies conducted in the sixties and seventies (see Table 3.2.3-1). A relatively high average salinity (32.5 ppt) was measured in a 1988 survey conducted by the Corps. The high salinity levels are directly influenced by the influx of Pacific Ocean water, which can have salinities as high as 33.2 ppt (Conomos 1979). Central Bay salinity measurements tend to increase slightly with depth where the more dense, saline waters of the Pacific Ocean intrude the Bay (COE 1976). Three depth- and tidal-averaged water salinity measurements collected in a transect across the mouth of South Bay (i.e., slightly southwest of Oakland Outer Channel) ranged from 32.4 to 32.6 ppt (COE 1990). Six bottom water samples collected in Outer Harbor demonstrated salinities ranging from 31.3 to 32.9 ppt (COE 1979).

Sedimentation and Erosion

The majority of sediment entering San Francisco Bay is eroded in the Sacramento and San Joaquin river basins and carried to the northern reach as suspended load and bedload (O'Connor 1991). The yearly suspended sediment load discharged to the Bay is on the order of 8 to 10 mcy, most of which is discharged during the winter months (PTI 1989). The highest total suspended solids (TSS) concentrations occur in the northern reach at the "null zone" (i.e., that portion of the northern reach where landward and seaward density currents have an equal and opposite effect) (up to 600 mg/l) and generally decrease downstream. Although sedimentation in the null zone and the northern reach, in general, leads to reduced suspended sediment loads in other portions of the Bay, the deposited sediments are also a source of resuspended sediments during winter storms and the summer months (O'Connor 1991). Krone (1966) estimated that up to 170 mcy of sediment is resuspended in the Bay yearly by wind and wave action.

The Corps (COE 1988) synthesized historic data on sediment patterns (Smith 1963) and bedforms (Rubin and McCulloch 1979) in Central Bay. Depositional areas showing rapid rates of sediment accumulation in Central Bay include the flanks of deep channels at the Golden Gate and those extending north from Angel Island to the Richmond Bridge. The area immediately south of Brooks Island is experiencing deposition at intermediate rates, while the southern portion of Berkeley Flats to Treasure Island is scouring (COE 1988).

In a recent study performed by Ogden Beeman & Associates, Inc. (1992), National Ocean Service charts generated in 1955 and 1990 were compared to assess changes in water depth. The analysis revealed areas where substantial accretions and reductions (i.e., due to erosion) of sediments have occurred over the 35-year period. Outer and Inner Oakland Harbor show net accretions of sediments on the order of 6 feet or more.

Total Suspended Solids

Mean TSS measurements collected in Central Bay surveys between 1960 and 1990 ranged from 18 to 36 mg/l (see Table 3.2.3-1). In comparison to other regions of San Francisco Bay, these TSS concentrations are relatively low (up to half those in other regions). In fact, Angel Island located in Central Bay is, overall, the least turbid region in San Francisco Bay (PTI 1989). In September of 1988, during a low freshwater inflow period, the Corps recorded average TSS measurements of 16 mg/l at the Golden Gate

Bridge and 34 mg/l at the entrance to South Bay (slightly southwest of the entrance to Oakland Inner Harbor) (COE 1990).

Nutrients

Municipal and industrial input (i.e., local stream inflow and sewage input), freshwater inflow, and the Pacific Ocean are the primary sources of nutrients contributing to San Francisco Bay's nutrients levels. Mineralization and bottom sediments are secondary sources. Nutrients levels fluctuate with periods of increased and decreased biological productivity and urban discharges. Consequently, utilization of nutrients (i.e., photosynthesis) and nutrient availability vary spatially and seasonally within the Bay. In general, Central Bay waters contain moderate concentrations of phosphate ($<5\mu\text{g-atoms/L}$), ammonia ($5\mu\text{g-atoms/L}$), and nitrate+nitrite ($10\text{--}20\mu\text{g-atoms/L}$). Central Bay nutrients levels are somewhat higher than ambient oceanic levels but correlate with the seasonal fluctuations induced by seasonal coastal upwelling. Sewage effluents are the primary contributors of ammonia, nitrate+nitrite, and phosphate; and the ocean and Delta outflow (i.e., the Sacramento and San Joaquin River Delta) supply the majority of silicates (Conomos et al. 1985). The Corps (COE 1979) reports total Kjeldahl nitrogen and total phosphate were measured ranging from 0.20 to 0.80 mg/l and from 0.10 to 0.21 mg/l, respectively. These measurements were taken from Outer Harbor bottom water samples.

Metals and Organic Chemicals

Pollutant levels in Inner Oakland Harbor water are not available. Concentrations of metal and organic parameters in Outer Oakland Harbor waters are generally the same as those described for Central Bay in section 3.2.2. The harbor is situated adjacent to a highly developed municipal and industrial area, a source of pollutants via urban runoff and point discharges (PPD 1990). Pollutants of concern identified in the PPD (1990) most likely reside in Oakland Harbor waters, although contamination levels may vary depending on seasonal runoff and flushing rates.

3.2.4 Disposal Site Options

This section describes existing hydrodynamic and water quality conditions at each of the three study areas under consideration in this investigation. Discussions of water quality include dissolved oxygen, temperature, salinity, total suspended solids, nutrients, and contaminant chemistry. Hydrodynamic conditions are assessed in terms of water circulation and wind/wave action and are presented along with the water quality data because water properties are influenced by regional hydrodynamic regimes.

3.2.4.1 Ocean Section 102

Hydrodynamics

EPA-sponsored surveys of current patterns and tides were conducted in 1991 in Gulf of the Farallones and the adjacent slope, including Study Area 5 (a mooring was located on the eastern edge of this area (EPA 1993a). Study Area 5 was intensively studied in 1990 and 1991 by the EPA to support the designation of a deep-water ocean dredged material disposal site under Section 102 of the MPRSA. The Ocean Section 102 site is located on the western boundary of this study area and is the same as the EPA Alternative Site 5 U.S. Navy's Section 103 site, the Navy Ocean Disposal Site (NODS). The U.S. Navy conducted separate surveys at the NODS to satisfy requirements under Section 103 for single-user

designation. Alternative Site 5, as described in EPA's Final EIS for site designation, is the preferred deep-water ocean disposal site. The following describes the tidal currents and other current patterns observed in Study Area 5.

The current regime observed during the surveys, consists of surface (0-75 m), mid-depth (75-800 m, at least 50 m above the bottom), deep (> 800 m, at least 50 m above the bottom), and near bottom (10-15 m above bottom) currents. Near surface currents exhibited an equatorward flow particularly in the spring during periods of upwelling. Upwelling tended to be weaker than at other sites along the California coast. Velocities are expected to be less than 10 cm/sec and variable with changes in seasons. Poleward flows were prominent in mid-depths in the area, likely due to the California undercurrent. The strength of the flows observed off of Point Sur varied throughout the year, with bursts of currents of 40 cm/sec observed (U.S. Navy 1993b). It is unclear as to whether a seasonal cycle affects the flow, or if it is a random occurrence. Similar patterns are expected within Area 5. Deep currents measured at depths of 1,420 m were weak (mean speed = 1 cm/sec) and variable, generally flowing to the northwest. Near bottom currents flowed to the northeast up a submarine canyon located within the area, and seemed to reflect interactions between tidal currents and the topography of the area.

Tidal currents in the near surface waters had maximum velocities of 5 to 6 cm/sec. These currents were not sufficiently strong to affect near surface current patterns, and are not expected to greatly affect the deposition of suspended materials. Mid-depth tidal currents, which exhibited daily amplitudes less than 5 cm/sec and semidiurnal amplitudes of up to 10 cm/sec (tidal currents reverse directions are hence time series waveforms), were not expected to alter the predominant current regime at these depths. However, it may increase cross-slope flow and dispersion of suspended material across isobaths. Although the tidal currents in deep waters are small (< 4 cm/sec), the currents at these depths were sufficiently weak to be reversed by the tidal currents, particularly the net along- and cross-slope flows. Both diurnal and semidiurnal near-bottom tidal currents tended to be enhanced at locations where topographic features, such as canyons within Area 5, intensified flows, and ultimately resulted in sediment transport. This process likely influences in the observed up-canyon flow within this region.

Other features expected to affect the dispersion of suspended materials include the Point Reyes upwelling jet sometimes observed within Area 5, and occasional eddies moving into the area (U.S. Navy 1993a). As with tidal currents, these may carry suspended material across isobaths.

Water Quality

EPA-sponsored water quality surveys were conducted within the Gulf of the Farallones along the continental slope in the vicinity of the disposal area, Ocean Section 102 (Ramp et al. 1992). Other studies performed within or in the vicinity of the study area include surveys performed within the vicinity of the NODS and California Cooperative Oceanic Fisheries Investigations (CalCOFI) surveys performed within the Gulf of the Farallones (U.S. Navy 1993a; EPA 1993a). Various water quality measurements of temperature, dissolved oxygen, pH, salinity, TSS, nutrients, and metals and organics concentrations are described below.

Temperature

Results of the surveys indicate that there is a high variability in the temperature profile related to seasonal changes in association with upwelling, changes in the California current system, wind conditions, and

various other current patterns within the area. According to satellite images of winter and spring sea surface temperatures which were taken of the region (Noble and Ramp 1992), outflow from San Francisco Bay tended to be a factor in the seasonal variability in temperatures in the shallower shelf areas (lower temperature during high outflow), although it did not appear to substantially affect the deeper slope areas where Ocean Section 102 is situated. Temperature profiles that were obtained from conductivity-temperature-density (CTD) casts in the summer (July 1991) indicated a well-mixed isothermal surface layer, below which temperatures decreased rapidly (thermocline), followed by gradual changes with depth into an isothermal layer near the bottom (U.S. Navy 1993a; EPA 1993a). Temperatures in the upper 100 m of the water column ranged from 11°C to 14°C. Temperatures dropped to 4°C at about 1,000 m and approximately 2°C at 2,000 m. The profiles were typical for California coastal areas in the summer.

Dissolved Oxygen

Data for dissolved oxygen concentrations within Ocean Section 102 were collected in the summer, July 1991 (EPA 1993a). The dissolved oxygen profile indicated an oxygen minimum zone (due to sinking and decomposition or grazing of organic material) at about 800 m with oxygen concentrations of 0.5 mg/l. Surface waters had oxygen levels of 8 mg/l, with a gradual decline in concentrations with depth through the mixed layer. Below the minimum zone, dissolved oxygen levels increased to greater than 3 mg/l at about 2,000 m.

pH

Although pH values within the study area were not determined during the recent EPA surveys, expected values may be inferred from other studies that have been performed in the area of the Gulf of the Farallones. Values reported ranged from 7.8 to 8.3 (Nybakken et al. 1984; IEC 1982), and are expected to vary with changes in carbon dioxide and oxygen levels resulting from changes in planktonic primary production (i.e., higher pH values where oxygen levels are high and carbon dioxide level are low as a result of high productivity) (EPA 1993a).

Salinity

Salinity profiles within the study area, which were obtained from the July 1991 CTD casts, indicated values of 32.9 ppt in surface waters (25 m) increasing to 34.7 ppt at a depth 3,900 m (U.S. Navy 1993a). Long-term average values obtained in surface waters during prior studies near SE Farallon Island were 33.4 ppt (EPA 1993a). As with temperature, salinity values varied seasonally, particularly in the surface layer, which had lower values in the winter and spring during periods of high river outflow (EPA 1993a).

Total Suspended Solids

TSS were not measured during the EPA surveys, although information is available for areas along the shelf in the Gulf of the Farallones (spring and summer), near the shelf-break (spring), and in similar depths. Values for regions over the shelf tended to be higher than slope and shelf break areas, ranging from 0.3 to 2.9 mg/l in the top 25 m of the water column (Gordon 1980). Concentrations near the shelf-break ranged from 0.08 to 2.51 mg/l (EPA 1993a; IEC 1982). TSS values obtained from the upper 400 m of the water column over the continental slope near Monterey ranged from 0.1 to 0.4 mg/l (U.S. Navy 1993a; Martin and Gordon 1988). Seasonal variations in TSS were observed during periods of high river outflow, high productivity, and strong storms, particularly in areas over the continental shelf. Areas

farther from shore, such as the proposed disposal site, are not expected to be as affected by the plume from San Francisco Bay.

Light transmissivity measurements were made in the fall (September 1991) as an indication of suspended solids and turbidity (EPA 1993a). Light transmissivity measurements made throughout the water column in Study Area 5 were 88-90 percent. Similar values were found along the shelf break, but much lower values were found over the continental shelf (transmittance levels of 10-80 percent) as a result of the higher concentrations of suspended solids. As with TSS values, light transmittance/turbidity is expected to vary seasonally in relation to seasonal changes in river outflow in San Francisco Bay, during periods of upwelling and high productivity, particularly over the continental shelf.

Nutrients

Nutrient concentrations within the study area are expected to be influenced by upwelling, seasonally variations in productivity, variations in surface winds influencing the mixed layer, turbidity, and to a small extent by outflow from San Francisco Bay. Nutrient concentrations were not specifically measured during the EPA surveys; however, nutrients were measured in the vicinity of the Gulf of the Farallones in July 1984 during CalCOFI surveys (EPA 1993a) and also at a continental slope site near Ano Nuevo, south of the NODS (U.S. Navy 1993a; Bruland 1980). Phosphate values during the CalCOFI surveys ranged from 0.25 to 2.0 micromoles per liter ($\mu\text{M/L}$) in surface waters, and increased to 4 $\mu\text{M/L}$ at depths greater than 1,000 m. Surface concentrations for nitrates and silicates were < 1-20 $\mu\text{M/L}$ and 1-40 $\mu\text{M/L}$, respectively. As is typical with nutrient concentrations, nitrate and silicate values were also greater with depth (100 meters) having concentrations of 10-30 $\mu\text{M/L}$ and 20-50 $\mu\text{M/L}$, respectively. Nutrient values obtained during the Navy studies resulted in surface values of 0.47 $\mu\text{M/kg}$, 1.0 $\mu\text{M/kg}$, and 3.8 $\mu\text{M/kg}$ for phosphates, nitrates, and silicates, respectively. Concentrations for depths greater than 1,000 m ranged from 2.6-3.27 $\mu\text{M/kg}$ for phosphates, 36.5-41.4 $\mu\text{M/kg}$ for nitrates, and 120-165 $\mu\text{M/kg}$ for silicates.

Metals and Organic Chemicals

Limited trace metal data available in the vicinity of the proposed disposal site includes studies reported by Bruland (1980) which were performed along the continental slope off central California. Trace metals measured included cadmium, copper, nickel, and zinc. Concentrations of these metals tended to be generally lower in surface waters than deeper waters due to uptake from biological processes. Cadmium had a maximum value of 0.115 $\mu\text{M/L}$ near the oxygen minimum zone, while zinc and nickel increased with depth, likely due to solubilization from particulates (U.S. Navy 1993a; EPA 1993a; Bruland 1980). Copper concentrations also increased with depth. Other factors which influence surface concentrations of these metals include upwelling, resuspension of bottom sediments by currents, atmospheric deposition, and transport from river outflow from San Francisco Bay.

Organic compounds are likely to enter the study site through various processes such as transport by San Francisco Bay outflow, atmospheric deposition, and oil spills or discharges (EPA 1993a). Detailed surveys of organic chemicals such as petroleum and synthetic hydrocarbons within the proposed disposal site were not recently conducted during the EPA and Navy surveys. However, studies were previously performed along the continental shelf and within the vicinity of the Gulf of the Farallones. The polyaromatic hydrocarbons phenanthrene and pyrene, and organochlorine compounds were below analytical detection limits (EPA 1993a; deLappe et al. 1980; IEC 1982). Petroleum hydrocarbons

exhibited very low concentrations, ranging from 140 to 280 nanograms per liter (ng/L) (EPA 1993a; Nybakken et al. 1984). Total polychlorinated biphenyls (PCBs) ranged from 24 to 105 ng/L, and diphenyldichloroethylene (DDE) had values of 4.6 to 27 ng/L (EPA 1993a; Nybakken et al. 1984). Trace amounts of chlordane, hexachlorocyclohexane, dieldrin, and toxaphene were also measured with values less than 500 ng/L (EPA 1993a; Nybakken et al. 1984).

3.2.4.2 Alcatraz

Hydrodynamics

Predominant forces behind Central Bay circulation patterns are local diurnal and semi-diurnal tidal cycles (Conomos 1979) (see section 3.2.3). The Alcatraz disposal site was originally designated as a dispersive disposal site due to its depth and high local water velocities. Recently, however, the site has been the focus of considerable hydrodynamic study because the Corps determined that the dredged materials deposited at the site were not dispersing at a rate equivalent to deposition and were, in fact, forming a mound. Between 1984 and 1986, the Corps dredged and removed sediments from the mound five times totaling 180,000 cubic yards (U.S. Navy 1990).

Two field studies were performed in 1985 and 1986 at the Alcatraz disposal site to characterize the temporal and vertical currents in the area. Winzler and Kelly (1985; cited in U.S. Navy 1990) deployed four current meter arrays (surface, mid-depth and bottom) within 1,500 feet of the disposal site boundary. In all cases, highest current speeds occurred during an ebbing tide, and in general, current velocities decreased with depth. Among all measurements, the highest surface, mid-water, and near-bottom current speeds were 142 cm/sec, 147 cm/sec, and 109 cm/sec, respectively.

In 1986, the Corps measured currents over a 5-month period in the vicinity of the disposal site. The study revealed that, on average, near-bottom ebb and flood currents were generally equivalent in speed. The average near-bottom current speed for three current meter moorings deployed south, east, and west of the site was 47 cm/sec. Maximum near-bottom speeds were measured as high as 100 cm/sec on any given tidal cycle. A station located approximately 4,000 feet west of the disposal site boundary, however, recorded greater near-bottom flood currents than ebb (SAIC 1987). These data are consistent with local bed forms that indicate that a boundary between ebb- and flood-dominant areas lies west of the disposal site (COE 1990). A fourth current meter mooring array was deployed just west of the site to measure surface, mid-depth, and near-bottom currents. The vertical current gradient measurements were made to understand the local hydrodynamics affecting plumes of disposed dredged material. The average surface current speed was 70 cm/sec (150 cm/sec maximum surface current speed), and decreased to 56 cm/sec on average (118 cm/sec maximum) mid-depth and 36 cm/sec on average (85 cm/sec maximum) near-bottom. Ebb currents near the surface were generally stronger than flood currents and moved to the northwest. Near-bottom ebb and flood currents were near equal, which was consistent with the findings of the three near-bottom current meter moorings (SAIC 1987).

Water Quality

Water quality conditions at the Alcatraz disposal site are, in general, consistent with those reported in section 3.2.3 for Central Bay waters. Specific data collected from the Alcatraz disposal site, when available, are presented below.

Temperature and Dissolved Oxygen

The average water temperature in Central Bay (and in the vicinity of the Alcatraz disposal site) is 14°C (COE 1976 Appendix C) (see section 3.2.3). This cool water temperature maximizes the dissolved oxygen content. Central Bay waters are well oxygenated with average dissolved oxygen concentrations of 7.6 mg/l (COE 1976 Appendix C).

pH

pH levels are typically stable in Central Bay, ranging from 7.3 to 8.0 (COE 1976 Appendix C). In a study conducted by Goddard et al. (1985) at the Alcatraz disposal site in 1984, a pH value of 7.8 was measured uniformly throughout the water column (U.S. Navy 1990).

Salinity

Central Bay water salinities are influenced by adjacent Pacific Ocean waters, and seasonal temperature, wind, and rain patterns. Salinity measurements were collected at the Alcatraz disposal site in 1984 by Goddard et al. (1985) and in 1985 by Winzler and Kelly. In the fall of 1984, salinity at the site ranged from 30.45 ppt near the surface to 30.68 ppt near the bottom, indicating isohaline conditions. In the summer of 1985, however, salinity increased with depth from 31.9 ppt to 34.6 ppt (U.S. Navy 1990).

Sedimentation and Erosion

The Corps performed laboratory and field studies to investigate the local sediment transport field and erosion rates in the vicinity of the site. The data from four studies (Trawle and Johnson 1986a, 1986b; Teeter 1987; Pankow 1988) suggested that consolidated materials dredged using a clamshell were not readily dispersed from the Alcatraz site. If the majority of material disposed at the site was in the form of clumps; most, if not all, of the material would be retained there. These predictions were noted in the field by SAIC (1987). Material dredged by clamshell from the San Rafael Creek Channel was placed at a disposal buoy within the Alcatraz disposal site. The deposit that formed consisted of cohesive, high density material surrounded by soft, low density high water content material. The soft deposit consisted of fluid mud that was highly susceptible to erosion and was probably removed from the site within hours or days. The remaining material consolidated over time with no significant loss of material due to erosion. SAIC concluded that the deposition of slurried dredged material would succeed in dispersing material following disposal and extend the life of the site (SAIC 1987).

The Corps (COE 1992a) *Environmental Assessment* summarized the behavior of dredged material following disposal at the Alcatraz disposal site. Immediately following disposal, a portion of the discharged material is tidally resuspended and moved off site. The amount of material retained at the site, based on bathymetric data and scow logs, is calculated to be 20 percent of the volume disposed within a 1,000-foot radius of the site center and 30 percent within 2,000 feet of the site center. Five to 10 percent of the material (i.e., fluid mud fraction) probably follows topographic lows to the east and south.

In a study performed by Teeter (1987), it was determined that approximately half (52.5 percent) of the material, especially high-water content material, disposed at the Alcatraz disposal site is resuspended and

transported off site. Including the 10 percent lost during disposal in the convective descent phase, a total of approximately 63 percent of the material disposed at the site is thought to be dispersed (COE 1992a).

The sediment suspended in the water column is probably equally dispersed in the east and west directions. Under normal tidal conditions, sediment transport is ebb-dominant but can fluctuate depending on seasonal fresh water in-flow and coastal storm patterns. Subsequent erosion of the disposal site mound is expected to transport sediment toward the Gate with a portion carried in-Bay as it approaches the open ocean.

Time-series bathymetric surveys were performed by the Corps in two recent studies to monitor the volumes of sediment dispersed from or retained at the Alcatraz disposal site. The first study assessed what percentage of the material dredged during the 38-foot Oakland Inner Harbor dredging project was dispersed from or retained at Alcatraz (COE 1993c), and the second monitored overall material gain or loss at Alcatraz for the period spanning from 5 March to 1 September 1993 (COE 1993d). The latter study was completed following the implementation of disposal restrictions at Alcatraz described in PN 93-3 (COE 1993e).

The first study involved the completion of two bathymetric surveys of the 2,000-foot-diameter Alcatraz disposal site on 25 August and 22 October 1992, bracketing the disposal of approximately 677,000 cy of material at the site. The analyses revealed that there was an overall sediment retention rate of 13 percent during this 2-month period of material placement. For an expanded area surrounding the disposal site (3,500 by 2,000 feet), there was an approximate retention rate of 39 percent. The peak of the disposal mound, however, remained relatively stable (-31 feet MLLW). The second study monitored a 7-month period during which approximately 926,000 cubic yards of material were placed at the site. The results of depth difference calculations revealed that there was an overall loss of 86,000 cy for a dispersive rate of 109 percent. Peak mound elevation never exceeded -30 feet MLLW and actually decreased during the 1993 surveys.

A visual comparison of the bathymetric contours representing the disposal mound at the Alcatraz disposal site between 1992 and 1993 shows that the mound is confined within the disposal site boundaries and that the mound itself has not increased in areal extent. This information is substantiated by the grain size analyses performed on sediments collected from locations outside of the disposal site boundary that show the persistence of a predominantly sandy substrate (see section 3.3.3.2).

Total Suspended Solids

TSS concentrations measured in several separate studies conducted at the Alcatraz disposal site are summarized in O'Connor (1991). These measurements are summarized in Table 3.2.4.2-1 and are relatively similar in magnitude. With the exception of the Johnson Offshore Services study, measurements of TSS concentrations in this table represent "snapshots" of turbidity at the disposal site.

The Johnson study provides continuous TSS measurements for up to 17 days. Winzler and Kelly's study took place in a 12-hour period during which water samples were collected at depths of 4, 7, and 11 meters from the surface. Measurements ranged from 56 mg/L to 9 mg/L with the maximum concentrations generally occurring at 11 meters. SAIC (1987) measured background TSS concentrations at Alcatraz ranging from 9 to 17 mg/L. These measurements were comparable to those collected by MEC who found the highest concentrations in and adjacent to Alcatraz in bottom waters (14 mg/L and

transported off site. Including the 10 percent lost during disposal in the convective descent phase, a total of approximately 63 percent of the material disposed at the site is thought to be dispersed (COE 1992a).

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Table 3.2.4.2-1 Total Suspended Solids Measurement at the Alcatraz Disposal Site

TSS (mg/L)		Study	Sample Depth	Method
Range	Mean			
9-56	19.3	Winzler & Kelly 1985	4-11m	gravimetry depth-integrated
10-37	19.5			
9-17	NA	SAIC 1987	Avg.	transmissometer
--	21	COE 1990	Avg.	gravimetry
10-20 (slack)	--	Johnson Offshore Services 1988 (cited in O'Connor 1991) ¹	4.6m	nephelometer
30-45 (ebb)	--		4.6m	nephelometer
--	6	MEC 1990 (cited in O'Connor 1991) ²	3m	nephelometer
--	14		6.1m	
--	22		9.15m	
--	14		Bottom	

Notes: NA = Not Available.

1. Corrected by a factor of 0.1 (O'Connor 1991).
2. First three measurements collected in the vicinity of Alcatraz; the last measurement collected at Alcatraz in bottom waters.

22 mg/L, respectively). In October of 1986, SAIC monitored 11 disposal events on six different days. Plumes of dredged material were tracked until they dissipated, usually within 15 minutes. Lower water column TSS measurements ranged from 44 to 165 mg/l. In one discrete event, a TSS reading of 80 mg/l persisted for 20 minutes (O'Connor 1991). However, TSS readings typically decreased below 40 mg/l fifteen minutes after any one disposal event (SAIC 1987).

In a study performed by Johnson Offshore Services (1988), three nephelometers were deployed at five different moorings at various times, ranging in duration from four to 17 days. Turbidity monitoring of waters in and adjacent to the Alcatraz disposal site was continuous during these deployment periods. Measurements were collected during periods of no disposal and during disposal events. Tidal elevations were measured concurrently to describe potential relationships between tidal cycles and TSS concentrations. Data were analyzed by the Aquatic Habitat Institute (AHI 1991) who demonstrated that peaks of TSS correlated with maximum tidal current velocities. Peaks in suspended solids were behind the maximum tidal current velocities by about 2.75 hours. Although AHI could not specifically attribute the turbidity peaks with the resuspension of material in and adjacent to the Alcatraz disposal site, several reasons were presented that refuted the possibility that turbidity was related to the resuspension of sediment at other sites and subsequently transported past Alcatraz. The most convincing evidence that supports the idea that erosion of Alcatraz site sediments is taking place is the fact that TSS peaks were noted during flood tides and not just during ebb tides. AHI pointed out that additional research is needed to determine the origin of suspended solids measured in these turbidity peaks at and adjacent to Alcatraz. It was discovered that, even after dredged material disposal had ceased at the Alcatraz disposal site, peak levels of TSS continued to occur during the time of maximum tidal currents.

Nutrients

Nutrients levels at Alcatraz are in line with Central Bay concentrations reported in section 3.2.3. Central Bay waters contain moderate concentrations of phosphate ($< 5\mu\text{g-atoms/L}$), ammonia ($5\mu\text{g-atoms/L}$), and nitrate+nitrite ($10\text{-}20\ \mu\text{g-atoms/L}$). Central Bay nutrients levels are somewhat higher than ambient oceanic levels but correlate with the seasonal fluctuations induced by seasonal coastal upwelling. Sewage effluents are the primary contributors of ammonia, nitrate+nitrite, and phosphate; and the ocean and Delta outflow (i.e., the Sacramento and San Joaquin River Delta) supply the majority of silicates (Conomos et al. 1985).

Metals and Organic Chemicals

Goddard et al. (1985) collected water immediately downstream from the disposal site during disposal operations. Among metals, cadmium ($1\text{-}3\ \mu\text{g/L}$) and zinc ($5\text{-}6\ \mu\text{g/L}$) were detected. All other metals, organochlorine compounds, or other chemicals of concern were determined at or above detection limits. Segar (1988) indicated toxic organic compounds associated with the materials released during disposal at Alcatraz were transported away from the site in the manner described in the Sedimentation and Erosion section above. The rapid dispersion of the sediments reduces the likelihood of dissolved contaminants occurring in concentrations lethal to aquatic life (COE 1990).

3.2.4.3 Bay Farm Borrow Area

Hydrodynamics

There is little prototype data describing current velocities and directions along with wave heights at the Bay Farm Borrow Area (BFBA). In addition to the controlling forces of water movement, localized seafloor topography in the South Bay influences current velocities and directions. Generally, maximum flow is in the deeper channelized portions of the South Bay while flow is less vigorous in the shallower shoals and bar features. Surface flow in the South Bay region has been reported to be between 70 cm/sec and 90 cm/sec with bottom flows ranging up to 70 cm/sec (Conomos 1979; PTI 1989). Single-event (one day) profiles of current velocities within the excavated portion of the borrow area indicated near bottom flows of approximately 15 cm/sec during both ebb and flood tides and surface flows of 17.49 cm/sec during the flood and 56.54 cm/sec during the ebb (OBAI 1990). Additional current meter data were collected during four seasonal water column surveys performed at the BFBA in 1993. Current meter moorings were deployed for periods of time up to six days during each survey. These data supported earlier findings that tidal currents move west-northwest during the ebb and east-southeast during the flood. Maximum mean current velocities at a station northeast of the borrow pit demonstrated a maximum mean current velocity of 16 cm/sec, peaking at 29 cm/sec. At a location southwest of the borrow pit in a channel approximately 10 feet deep, a maximum mean current velocity of 48 cm/sec was recorded, peaking at 64 cm/sec (SAIC 1994).

The role of delta outflow on currents in the Bay Farm area is relatively unknown. However, based upon observations of salinity and temperature made at the BFBA during various studies (OBAI 1990, 1991; SAIC 1992a-d, 1993a-b), it is known that fresh waters from the delta and other localized sources significantly influence water column properties at the BFBA on a seasonal basis. This trend has also been documented in other studies (McCulloch et al. 1970; Conomos 1979).

Water Quality

Waters at and adjacent to the BFBA can be described in terms of their physical and chemical attributes measured at specific sampling stations. In addition, water column parameters can be described in terms of spatial (between stations), vertical (within a station), and temporal variation. In order to adequately characterize the existing conditions at the site, representative site data should be compared to regional data. Regional processes influence the hydrodynamics of the BFBA. Specific parameters or hydrodynamic elements of the region, as they pertain to the BFBA, are summarized in the following discussion.

Temperature

During seasonal surveys of the BFBA (OBAI 1991; SAIC 1992a-d, 1993a), water temperature was measured as profiles over the entire water column. The trend in water temperature between all stations is very similar, with a distinct temperature minimum in February and a maximum in May and August. Water temperatures measured at the BFBA during the 1993 Seasonal Water Column Surveys ranged from a minimum of 11°C in February to a maximum of 21°C in August (SAIC 1994). The seasonal trend observed in BFBA waters is a response to increased atmospheric warming and solar heating in the summer and decreased atmospheric temperatures, influx of cold fresh water, and heat loss from marine

waters during the winter. Similar trends in water temperatures have been observed in previous studies and syntheses (Conomos 1979).

In addition, the seasonal pattern of water temperature at all sampling stations show that BFBA waters are well mixed within a sampling event. Waters are well mixed within a station (vertically) and between stations (horizontally). This indicates that BFBA site waters are functionally a homogeneous water mass in terms of temperature, on an instantaneous basis. The character of the seasonal water mass changes and the mixing processes that change the properties of the water column are poorly documented.

Dissolved Oxygen

Dissolved oxygen (DO) concentrations were measured from bottom and surface waters during seasonal surveys of the BFBA (OBAI 1991; SAIC 1992a-d, 1993a). Dissolved oxygen levels measured at the BFBA are higher than the 5.0 mg/l value recommended by the EPA (1986) which represents the minimum level needed to sustain biological life. The lowest dissolved oxygen concentration were measured in August 1992 at 6.04 mg/l whereas maximum DO levels were measured in February 1992 at 11.72 mg/l. For stations at the BFBA, DO concentrations measured from surface waters were nearly identical to those measured from bottom waters (OBAI 1991; SAIC 1992a-d, 1993a), indicating that waters within a station are well mixed. In addition, similar DO concentrations between stations indicates that with respect to DO, site waters are well mixed.

Salinity

The BFBA is influenced by two dominating forces: the influx of fresh water from fluvial and overland discharge and tidal exchange of saline waters through the Golden Gate from the Pacific. As with temperature, and DO, salinity was measured on a seasonal basis (OBAI 1991; SAIC 1992a-d, 1993a). Measured salinities range from 25.17 ppt in February 1992 to 32.37 ppt in August 1991. Most months show salinities between 30 and 32 ppt. However, the February 1992 season was characterized by increased levels of precipitation and resultant increased riverine and overland fresh water discharge. May 1992 estimates are transitional between those measured in other months and the February 1992 low. Based on profiles at single sampling locations, salinities are uniform within a station. Similarly, salinity does not vary by more than 1.5 ppt across the site during any seasonal survey, indicating that BFBA site waters are well mixed. Estuaries are typically characterized by strong salinity gradients, and the relative uniformity of salinity measured at the site substantiates a high degree of mixing.

Sedimentation and Erosion

Sedimentation and erosion have not been studied in detail in South Bay. Krone (1979) concluded South Bay is erosional by comparing successive bathymetric surveys. Very fine-grained material probably erodes and is carried to the ocean or to marshes (Krone 1979). Despite the overall erosional character of South Bay, the BFBA itself is a depositional site simply because it is a depression where sediment is likely to accumulate. This is evidenced by the fine-grained texture of the pit sediments.

A study to determine how frequently material potentially placed at the BFBA would move under the influence of waves and currents was performed by the Corps (COE 1992b). The study used sediment-transport calculations that take into account the relative values of bottom shear stress caused by waves and currents and critical shear stress for erosion, which is an inherent property of the dredged material.

For depths greater than -20 feet MLLW, bottom sediments will largely remain in the BFBA because, based on the results of the calculations, they would be resuspended less than 10 percent of the time and potentially as little as 1 percent of the time. Presently, the BFBA is greater than the -20 feet MLLW threshold used in the calculations. The presence of fine-grained materials within the BFBA pit corroborates the results of the sediment-transport calculations.

Total Suspended Solids

TSS measurements were obtained from samples collected during seasonal surveys of the BFBA (OBAI 1991; SAIC 1992a-d, 1993a). TSS concentrations ranged from 2.1 mg/l in November 1990 to 120 mg/l in August 1992. TSS maxima were observed during both the August 1991 and August 1992 surveys. Both of these surveys were marked by periods of high diurnal winds (SAIC 1992a-d, 1993a) which may have caused the local resuspension of sediment by wind-generated waves.

Nutrients

Water samples collected at the BFBA have not been analyzed for ambient nutrients concentrations. Conomos et al. (1985) indicate the southern boundary of South Bay is a primary source of phosphate, ammonia, and nitrate+nitrite to this area due to local stream in-flow and sewage effluent. Because the borrow area is located in the northern portion of South Bay, nutrients levels are more similar to Central Bay concentrations than the southern boundary of South Bay. As such, a median concentration of silicate in an area near the pit is approximately 75 $\mu\text{g-atoms/L}$; phosphate < 5 $\mu\text{g-atoms/L}$; nitrate+nitrite 15 to 20 $\mu\text{g-atoms/L}$; and ammonia 5 to 10 $\mu\text{g-atoms/L}$.

Metals and Organic Chemicals

The presence of metals or organic compounds in BFBA site waters will be primarily a function of runoff or wastewater input into the South Bay. An additional source of these compounds to Bay Waters could be local sediments which could resuspend into the water column. Waters for trace analyses for metals and organic compounds were collected in November 1990 (OBAI 1991). Few analytes were present at levels greater than detection in BFBA site waters. These analytes were mercury (0.005 $\mu\text{g/L}$), lead (1.55 $\mu\text{g/L}$), and monobutyltin (10.0 $\mu\text{g/L}$). All other analytes were not detected. These undetected analytes include the remaining metals, polycyclic aromatic hydrocarbon (PAH) compounds, phenols, total petroleum hydrocarbons, pesticides, oil and grease, and PCBs.

3.2.4.4 Leonard Ranch/Redwood Landfill

Leonard Ranch Rehandling Option

GROUNDWATER

Hydrogeology. The Leonard Ranch site lies within Petaluma Valley, which is part of the Sonoma Valley groundwater basin (figures 3.2.4.4-1 and 3.2.4.4-2). The site is in the lower portion of the basin where south-moving groundwater ultimately discharges into San Pablo Bay. Groundwater in Petaluma Valley is within (1) underlying unconsolidated sediments including bay mud deposits, alluvium, and alluvial fan deposits; (2) volcanic rocks and sediments including the Sonoma Volcanics and Tolay Volcanics;

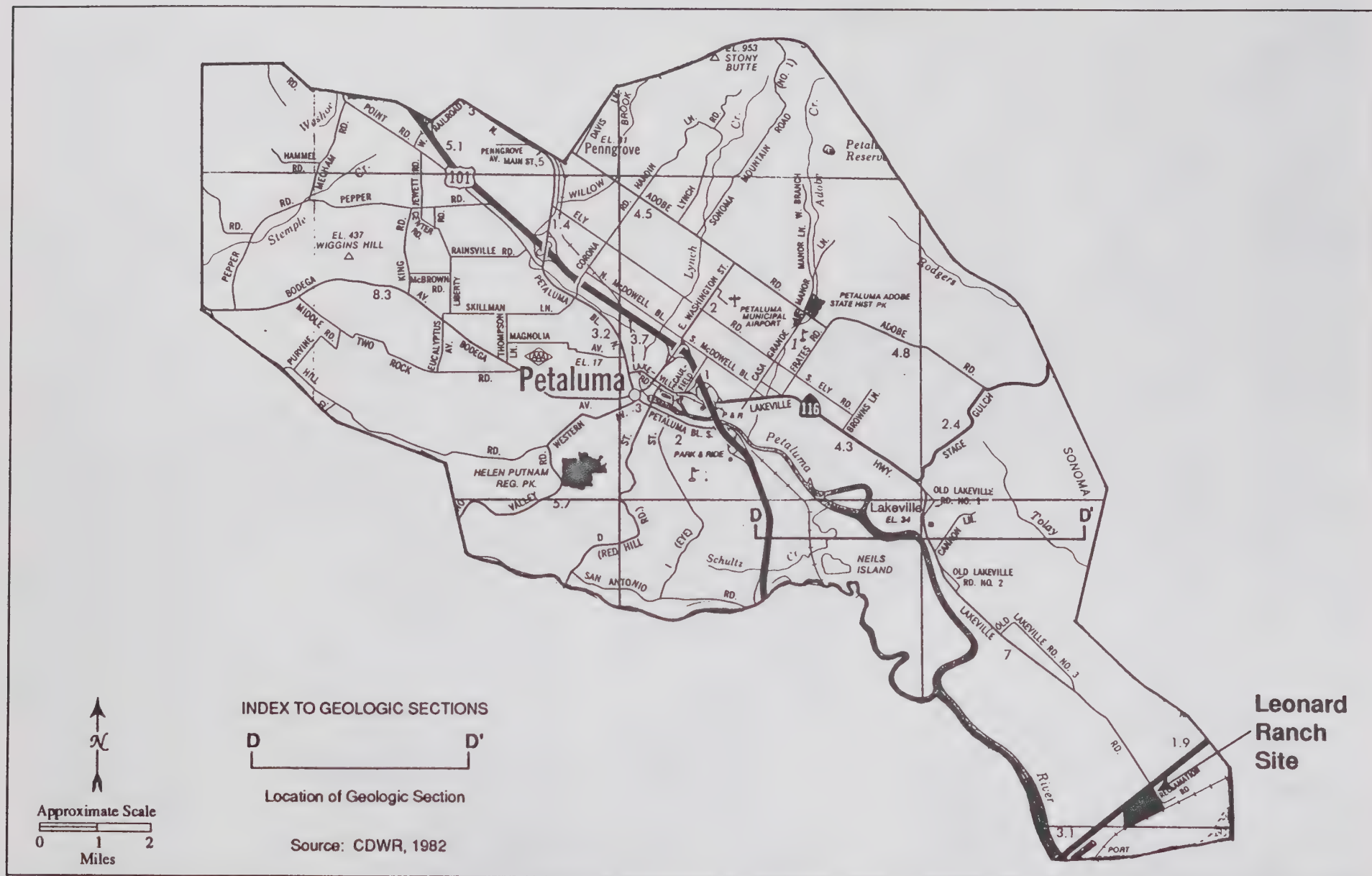


Figure 3.2.4-2

SONOMA VALLEY GROUNDWATER BASIN, PETALUMA VALLEY

(3) sandstone of the Merced Formation; and (4) consolidated clay and shale of the Petaluma Formation. Cross section D-D' illustrates general hydrogeologic relationships north of the Leonard Ranch site (Figure 3.2.4.4-3). Generally, alluvium, alluvial fan deposits, and the Merced Formation represent high water-yielding formations (greater than 300 gal/min) while the low water-yielding formations (1 to 100 gal/min) include the Petaluma Formation and shallow bay mud. The Sonoma Volcanics and Tolay Volcanics have highly variable water-yielding properties (CDWR 1982). Unconsolidated deposits range from 0 to over 500 feet thick (CDWR 1975).

In November 1993, a preliminary groundwater investigation was performed to investigate shallow groundwater flow directions and groundwater quality at the Leonard Ranch site (HLA 1993a). As part of that investigation, five piezometers were installed and groundwater samples were collected for TDS analyses.

A preliminary well survey was performed for wells and piezometers within approximately 1 mile of the sediment containment and dewatering area of the Leonard Ranch site to obtain information pertaining to the usage and quality of groundwater in the area. Data were obtained from the review of files at California Department of Water Resources (CDWR) and the San Francisco Bay RWQCB (Oakland) offices, from CDWR publications, from published data provided by the Port of Oakland, and from information provided by a former local resident (Dickson 1993). Wells and piezometers identified during the survey are shown on Figure 3.2.4.4-1.

Based on the results of this investigation, shallow groundwater at the Leonard Ranch site ranges from approximately 5 to 14 feet below ground surface within bay mud deposits. Based on water level data from on-site piezometers, the general groundwater flow direction appears to be toward the northeast. This flow direction of shallow groundwater may be in response to recharge by the Petaluma River and/or the adjacent Sonoma-Marin marina and dredged material drying site west of Leonard Ranch. It is not known whether shallow groundwater at the site is tidally influenced or to what degree surface water drainage may affect local groundwater flow directions.

Groundwater Quality. In the vicinity of the Leonard Ranch site, shallow groundwater within the bay mud of the lower Petaluma Valley is characterized as brackish and is a sodium and magnesium chloride water type. Water quality problems affecting shallow groundwater in the area include high concentrations of boron, sodium, chloride, and total dissolved solids (TDS), which can cause severe problems for agricultural use. Documented TDS and hardness in groundwater in this area range from 1,130 to 23,230 mg/l and 294 to 1,270 mg/l, respectively. High salinity in fine-grained sediments in this area is the result of brackish water being trapped between clay particles when the material was deposited. Also, alluvial fan deposits near the Petaluma River produce brackish water as a result of saltwater intrusion in response to groundwater pumping (CDWR 1982).

Shallow groundwater samples collected from five piezometers (LRP1 through LRP5) on or adjacent to the site had specific electrical conductance measurements ranging from 11,900 micromhos per centimeter ($\mu\text{mhos/cm}$) to 18,600 $\mu\text{mhos/cm}$ (see Appendix D). Two of these groundwater samples, representing the highest and lowest field electrical conductivity measurements, had TDS values detected at 13,450 and 23,230 mg/l, confirming that the shallow groundwater beneath the site is brackish to saline (HLA 1993a). Also, an on-site artesian well (LR7) that is installed to a depth of at least 300 feet, appears to be brackish (Dickson 1993). However, groundwater quality data from two deep wells (LR5 and LR6 completed to depths of 520 feet and 225 feet below the ground surface, respectively) near the Leonard Ranch site

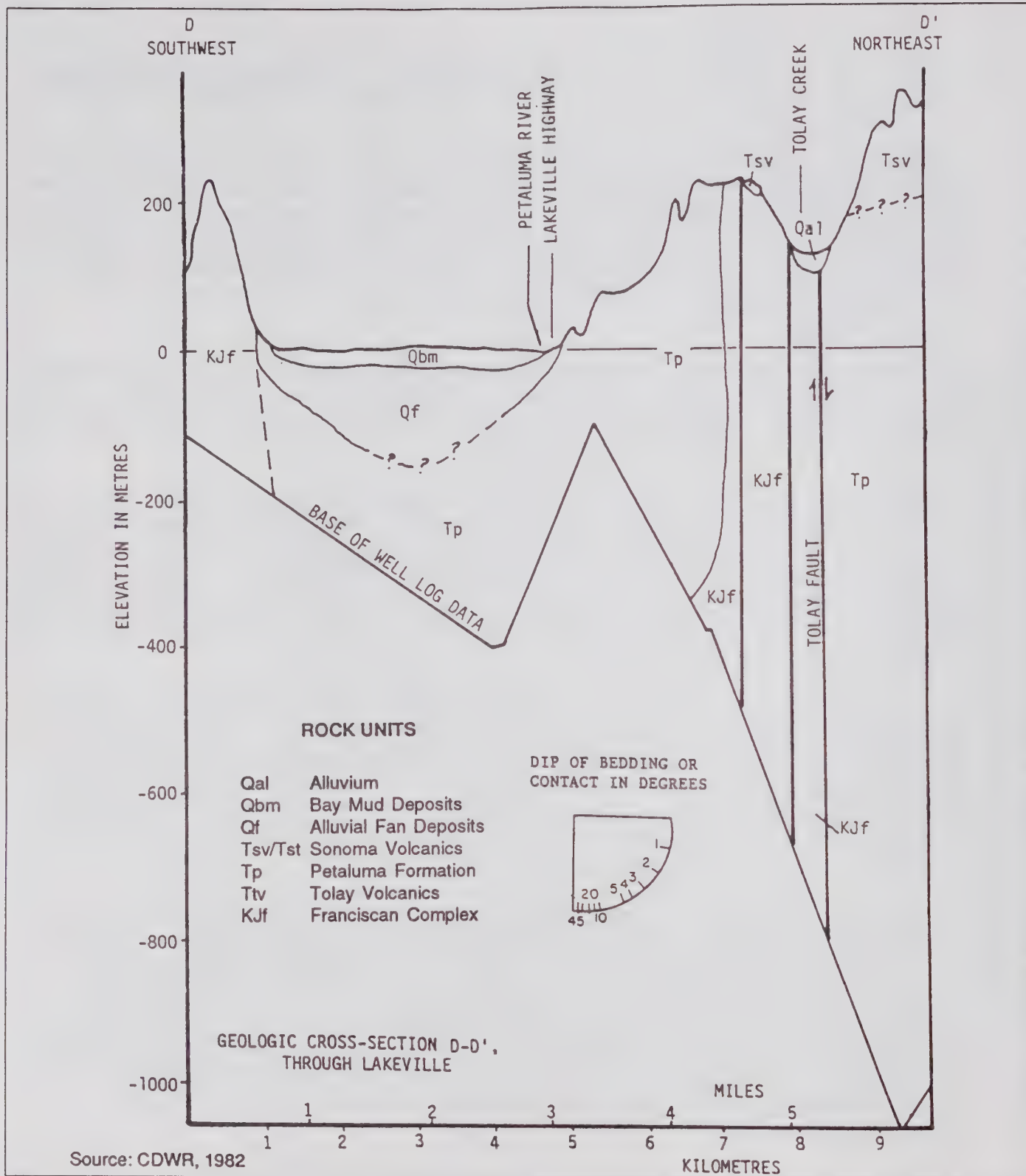


Figure 3.2.4.4-3

GEOLOGIC CROSS-SECTION D-D' THROUGH LAKEVILLE, PETALUMA VALLEY

1 indicate that relatively fresher water exists at greater depths near the site. One Sonoma Baylands well
2 (LR8) and four other wells (LR1 through LR4) along Lakeville Highway to the northwest of site were
3 installed for agricultural or domestic use, respectively, but no depth or water quality information for these
4 wells are available.

5
6 No evidence was found during the review of RWQCB files that would indicate that fuel or toxic waste
7 releases have impacted the shallow groundwater in the vicinity of the site. However, as part of a 1989
8 site investigation (Tetra Tech 1989), surface soil samples (i.e., less than 8 inches deep) were collected
9 from beneath above-ground fuel storage tanks (ASTs), adjacent to storage drums, and from stained areas
10 on the eastern side of the site. One soil sample collected beneath the above-ground storage tanks
11 contained 16,000 mg/kg total petroleum hydrocarbons (TPH) as gasoline and related contaminants. This
12 level of TPH exceeds commonly applied clean-up levels of about 100 ppm (LUFT 1989). According to
13 the RWQCB's LUFT Manual, which provides guidance for conducting investigations at UST sites, TPH
14 as gasoline concentrations detected within the first two feet of native soil beneath a UST would require
15 that a soil and groundwater investigation be conducted. Based on this guidance and the lack of additional
16 soil chemical data from this area, further investigation is needed to assess the presence or absence of TPH
17 as gasoline in soil and groundwater and the need for and scope of potential remediation.

18 19 SURFACE WATER

20
21 Hydrology. The existing site is reclaimed marsh and baylands, which is surrounded by levees, dikes,
22 and canals. Construction of the dikes and levees took place around the beginning of the century, when
23 the land was drained and agricultural practices were implemented. The tillage and planting activities
24 associated with the agricultural uses since that time have altered much of the natural drainage features
25 of the parcel.

26
27 The northeastern corner of the site along Reclamation Road drains to the southwest toward a meandering
28 swale, which historically drained areas to the north of SR 37 prior to the construction of the elevated road
29 surface (Figure 3.2.4.4-4). This swale is 50 to 100 feet wide at the top of bank and drains toward the
30 southeastern corner of the site where it discharges into the channel that flows between the Leonard Ranch
31 and Sonoma Baylands site. Surface runoff to the north of SR 37 drains into a drainage ditch that flows
32 to the southwest along the northern right-of-way.

33
34 The central portion of the site drains to the southwest into a drainage ditch, which intersects the SR 37
35 right-of-way approximately 100 feet from the northwestern property corner. The entire surface area of
36 this watershed has been altered by heavy agricultural activity and is characterized by relatively flat
37 topography. Five ditches parallel SR 37 approximately 400 feet apart and drain water from this central
38 area toward a separate north-flowing ditch. These man-made earthen ditches have a top width of 10 feet
39 and a depth of 2 feet. The concentrated flow from this central portion of the site drains into a culvert
40 underneath SR 37 and enters a drainage ditch, which discharges into the Petaluma River to the west.

41
42 The surface drainage from the site area to the southwest of the north-flowing drainage ditch ponds along
43 the existing levee adjacent to the Port Sonoma-Marin property to the west. A portion of this site area
44 drains to the southwest corner of the property and the remainder drains toward two man-made drainage
45 ditches, which drain the surface runoff in a northerly direction toward SR 37. Surface drainage in the
46 southwest corner of the site is less efficient than the central area, and water ponds in this area
47 occasionally for several days at a time.

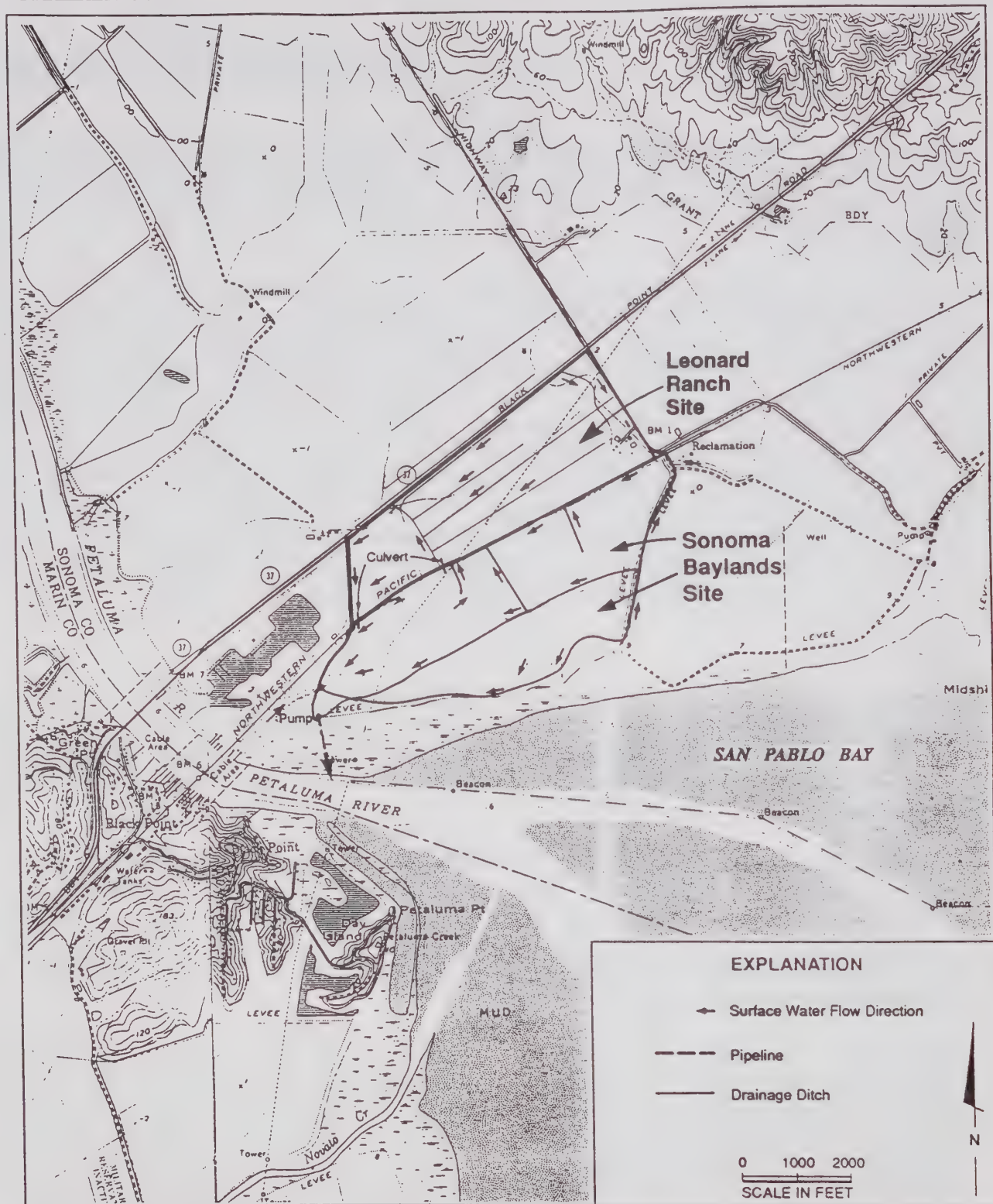


Figure 3.2.4.4-4

**SURFACE WATER DRAINAGE, LEONARD RANCH REHANDLING SITE
AND SONOMA BAYLANDS DISPOSAL SITE**

The hay fields on and surrounding the Leonard Ranch site are managed to minimize the duration of standing water. The majority of winters in the region typically host a series of small storm events that create standing water on the site (Marcus 1994). In the average year, the existing pump located at the southwestern corner of the site can easily accommodate the runoff, and ponding does not extend beyond several days. According to the landowner who has farmed or lived on the Leonard Ranch site for 47 years (Marcus 1993a), if a rainstorm generates 1 to 2 inches of precipitation, one or two days is required to remove the ponding from the fields. Even less time is required if the soils are not saturated from a previous storm event. For an average rainfall year, if a series of storms has saturated the soils, ponding can last up to five days. During extreme storm events (such as the storms in January 1983 and February 1986 that locally generated 100-year and 50-year floods, respectively) up to one month may be required to remove ponding from the fields.

Flooding. The Leonard Ranch site is potentially subject to flooding due to overbank flood flows from the Petaluma River, high tides and coastal wave action from San Pablo Bay, or a combination of these potential flooding mechanisms. Although much of the site area and adjacent areas have been surrounded by the construction of levees and dikes the entire site is considered to be within a Zone VI flood hazard area (FEMA 1982). This Zone VI designation reflects an area of 100-year coastal flood with velocity (wave action) and the entire site has a base flood elevation of 6 feet above MSL. Failure of any of the man-made levees or dikes would increase the potential for flooding on the project site.

Water Quality. Surface water quality is predominantly brackish due to the topography and proximity of the Leonard Ranch rehandling site to San Pablo Bay. Seasonal inputs of freshwater infiltrate into the soil and enter drainage ditches or flow over the surface and enter drainage ditches. Salinities have been measured in surface water samples taken from on-site drainage ditches at the end of March 1989, an unusually wet month. In the northern and northeastern corners of the property (north of SR 37), salinities were approximately 1 part per thousand (ppt). In the drainage ditches south of SR 37, salinities ranged from 5 to 12 ppt. Ponded surface water had salinities of 3 to 4 ppt and near the pump station, 12 ppt (CCCSLT 1989).

Water samples collected by HLA (unpublished data) in May 1990 from the mouth of the Petaluma River at low and high tide contained chloride concentrations of 14,200 mg/l and 14,800 mg/l, turbidity of 53.0 nephelometric turbidity units (NTU) and 105 NTU, TSS of 111 mg/l and 198 mg/l, pH of 7.6 and 7.9, specific conductance of 32,000 μ mhos/cm and 32,800 μ mhos/cm, and total dissolved solids of 25,400 and 26,400 mg/l, respectively.

3.2.4.5 Sonoma Baylands

Groundwater

HYDROGEOLOGY

The Sonoma Baylands Restoration site lies within Petaluma Valley, which is part of the Sonoma Valley groundwater basin (Figure 3.2.4.4-2). The Sonoma Valley groundwater basin is described above in section 3.2.4.4.

A preliminary well survey was performed for wells within approximately 1 mile of the tidal marsh restoration area of the Sonoma Baylands site to obtain information pertaining to the usage and quality of

groundwater in the area. Data were obtained from the review of files at CDWR and the SF-RWQCB offices as well as from CDWR publications. One well (LR8) may exist at the Sonoma Baylands site according to a former tenant, Fredrick Dickson, as shown on Figure 3.2.4.4-1; however, this well is no longer in use.

Shallow groundwater north of the site at the nearby Leonard Ranch site ranges from approximately five to 14 feet below ground surface within bay mud deposits. Based on water level data from the Leonard Ranch piezometers (Appendix D and HLA 1993a), the general groundwater flow direction appears to be toward the northeast. This flow direction of shallow groundwater may be in response to recharge by the Petaluma River and/or the adjacent Sonoma-Marin marina and dredged material drying site west of Leonard Ranch. It is likely that shallow groundwater at the Sonoma Baylands is tidally influenced; however, the degree of expected tidal influence, the importance of surface water drainage on local groundwater flow directions, and if groundwater conditions observed at nearby Leonard Ranch apply to the site remains unknown.

GROUNDWATER QUALITY

In the vicinity of the Sonoma Baylands Restoration site, shallow groundwater within the bay mud of the lower Petaluma Valley is characterized as brackish and is a sodium and magnesium chloride water type. Water-quality problems affecting shallow groundwater in the area include high concentrations of boron, sodium, chloride, and TDS, which can cause severe problems for agricultural use. TDS and hardness in groundwater in this area range from 1,130 to 2,530 mg/l and 294 to 1,270 mg/l, respectively. High salinity in fine-grained sediments in this area is the result of brackish water being trapped between clay particles when the material was deposited. Also, alluvial fan deposits near the Petaluma River produce brackish water as a result of saltwater intrusion in response to groundwater pumping (CDWR 1982). The presence of brackish surface water throughout the site suggests that groundwater beneath the site may also be brackish. However, groundwater quality data from two deep wells (LR5 and LR6 completed to depths of 520 feet and 225 feet below the ground surface, respectively) near the Sonoma Baylands site indicates that relatively fresher water exists at greater depths near the site (see tables D-1 and D-2 in Appendix D). Four other wells along Lakeville Highway to the northwest of site were installed for domestic use, but no depth or water quality information for these wells are available.

No evidence was found during the review of RWQCB files that would indicate that fuel or toxic waste releases have impacted the shallow groundwater in the vicinity of the site. However, as previously discussed, surface soil samples were collected from beneath above-ground storage tanks, adjacent to storage drums, and from stained areas approximately 700 to 1,000 feet north of the site on the upgradient Leonard Ranch site. One soil sample contained 16,000 mg/kg TPH as gasoline and related contaminants. Due to the lack of data regarding the distribution of TPH as gasoline in the soil and its presence or absence in groundwater at the Leonard Ranch site, it is unknown if TPH as gasoline has migrated onto the Sonoma Baylands site. However, based on recent flow directions calculated for Leonard Ranch (east-northeast) (HLA 1993), it appears unlikely that Sonoma Baylands groundwater has been impacted by TPH detected in shallow soils at the Leonard Ranch site.

Surface Water

HYDROLOGY

The existing site comprises reclaimed marsh and baylands surrounded by levees, dikes, and canals. Construction of the dikes and levees took place around the beginning of the century, when the land was drained and agricultural practices were implemented. The tillage and planting activities associated with the agricultural uses since that time have altered much of the natural drainage features of the parcel. Subsidence has occurred across the parcel since its reclamation for agricultural use. The existing ground surface ranges in elevation from -1.5 to -3.5 feet National Geodetic vertical datum (NGVD).

On-site drainage is controlled by a series of ditches that bisect the central portion and lie along the northern perimeter of the Sonoma Baylands site (Figure 3.2.4.4-4). Surface runoff in these ditches is directed southwest or northwest toward an ultimate point of concentration at an existing pumping station. This existing pumping station, located in the southwestern corner of the site, discharges the on-site surface runoff via a discharge pipe into San Pablo Bay. Surface runoff between these southwest- and northwest-trending agricultural ditches is inefficient due to the repeated tillage of the ground surface. Field drainage not captured by the ditches is directed toward localized depressions. Many of the depressions have no connection to the surrounding ditches; therefore no surface runoff from the depressions discharges from the site.

Surface drainage runoff from off-site drainage areas is eliminated by drainage controls surrounding the site. A 30-foot-wide drainage ditch and railroad right-of-way elevated embankment immediately north of the site direct surface runoff from the Leonard Ranch site toward the pumping station to the southwest. An existing drainage ditch along the eastern boundary of the site also intercepts off-site surface runoff. An existing levee with a crest elevation that ranges from 5 to 8.6 feet NGVD lies along the southern perimeter of the site, and forms a barrier to tidal and wave action from the bay.

FLOODING

The Sonoma Baylands Restoration site is potentially subject to flooding due to overbank flood flows from the Petaluma River, high tides and coastal wave action from San Pablo Bay, or a combination of these potential flooding mechanisms. Although much of the site area and adjacent areas have been surrounded by the construction of levees and dikes, the entire site is considered to be within a Zone VI flood hazard area (FEMA 1982). This Zone VI designation reflects an area of 100-year coastal flood with velocity (wave action), and the entire site has a base flood elevation of 6 feet above MSL. Subsequent analyses of maximum coincident high-tide storm surge and wave run-up elevations for the Sonoma Baylands site indicate the maximum 100-year high-tide, including wave setup and run-up, to be as high as 7.9 feet NGVD (CCC 1991). Failure of any of the constructed levees or dikes would increase the potential for flooding on the project site.

WATER QUALITY

Surface water quality in the project vicinity is predominantly brackish due to the topography and proximity to San Pablo Bay. Salinities have been measured in surface water samples taken from drainage ditches on the Leonard Ranch (to the north) and Sonoma Baylands sites at the end of March 1989, an unusually wet month. In drainage ditches located in the northern and northeastern corners of the Leonard

Ranch property to the north of SR 37, salinities were approximately 1,000 ppm. In the drainage ditches on the Leonard Ranch site south of SR 37, salinities ranged from 5,000 to 12,000 ppm. Ponded surface water sampled near the pump station on the Sonoma Baylands site had salinities which ranged from 3,000 to 12,000 ppm (CCCSLT 1989).

HLA collected water samples in May 1990 from the mouth of the Petaluma River at low and high tide. The samples contained chloride concentrations of 14,200 and 14,800 mg/l, turbidity of 53.0 and 105 NTU, TSS of 111 and 198 mg/l, pH of 7.6 and 7.9, specific conductance of 32,000 and 32,800 μ mhos/cm, and total dissolved solids of 25,400 and 26,400 mg/l, respectively.

3.2.4.6 Galbraith Golf Course

Groundwater

HYDROGEOLOGY

The Galbraith Golf Course site is located along the eastern San Francisco Bay in the southern East Bay Plain area of the Santa Clara Valley groundwater basin (CDWR 1980). Groundwater occurs in all geologic units in the East Bay Plain area; however, the principal groundwater reservoir is associated with the older alluvium (figures 3.2.4.6-1 and 3.2.4.6-2). Most groundwater in the East Bay Plain area is confined as a result of overlying clay deposition (ACFCWCD 1988). Shallow groundwater flow near the site occurs in aquifers of the San Leandro alluvial fan, which generally consists of discontinuous lenses and layers of sand and gravel separated by thick layers of clay (EMCON 1991). Shallow aquifers within 50 feet of ground surface in the vicinity of the site are often perched and may be confined by clay beds. These shallow aquifers generally yield less than 35 gallons per minute (gpm). Below these shallow aquifers, at a depth of between 30 and 100 feet, is the Newark Aquifer, which typically yields 20 to 100 gpm (Aquascape 1990). The direction of regional groundwater flow in the area is west, toward San Francisco Bay.

The measured depths to groundwater in 15 on-site monitoring wells installed in 1991 and 1993 (BEC 1991; HLA 1993 unpublished data) ranged from approximately 2.5 to 15.5 feet below ground surface. The groundwater table is generally either within fill materials or within the upper few feet of bay mud or alluvium. On the basis of these results and the results of a tidal influence study, the general site-wide groundwater flow direction appears to be toward the west to southwest (Figure 3.2.4.6-3). This conclusion takes into account that wells are screened in different lithologic units and that the drainage channel is tidally influenced, and, therefore, wells adjacent to the channel (Wells G31b, G31c, G31f, and G31g), which were not included in the tidal influence study, may also be tidally influenced. Local flow directions are expected to vary depending on the proximity to the tidally-influenced drainage channel, irregularities in the fill/bay mud contact, and heterogeneities in fill materials. Comparison of water levels in paired wells screened in bay mud and alluvium (Wells G31l and G31m; G31n and G31o) indicate that the vertical flow between the units are relatively insignificant; the differences in water levels between paired wells may be more a result of tidal influence rather than net vertical flow. Sandy alluvium at depth beneath the site appears to have slightly greater hydraulic communication with the bay than overlying clayey bay mud and alluvium.

A preliminary well survey was performed for wells within approximately one-half mile of the Galbraith Golf Course site to obtain information pertaining to the usage and quality of groundwater in the area.

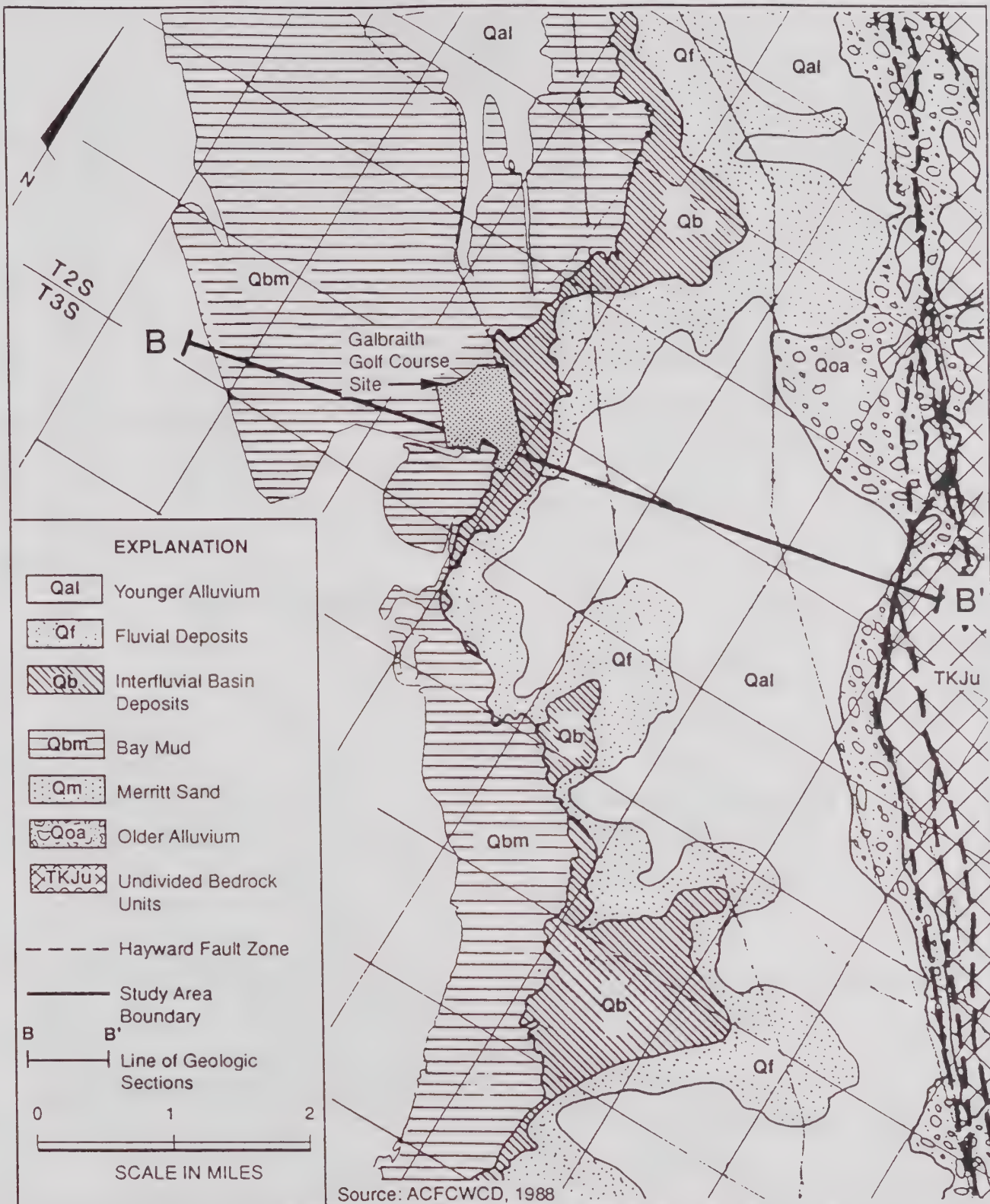


Figure 3.2.4.6-1

GENERALIZED GEOLOGIC MAP, GALBRAITH GOLF COURSE

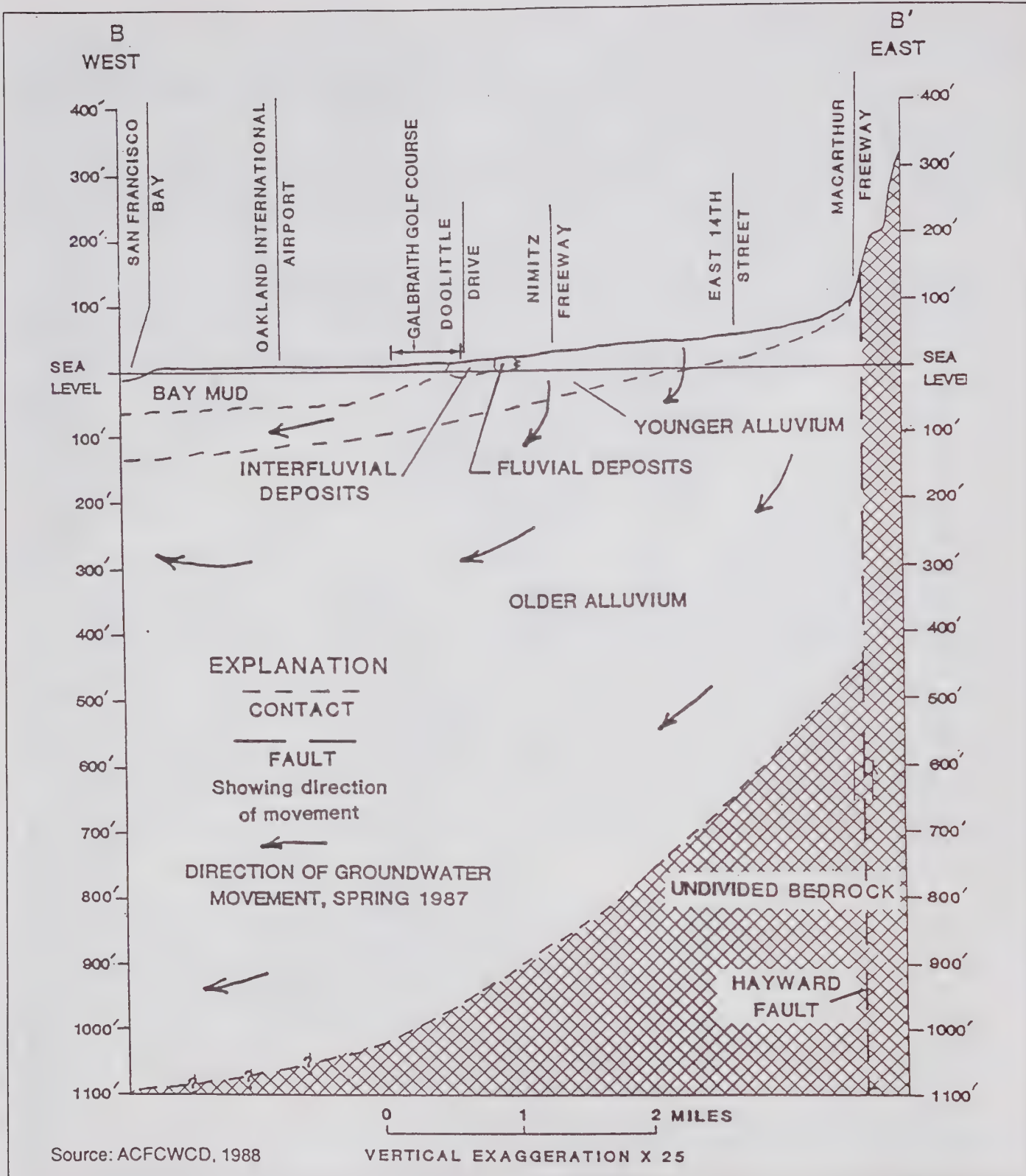


Figure 3.2.4.6-2

CROSS-SECTION B-B', GALBRAITH GOLF COURSE

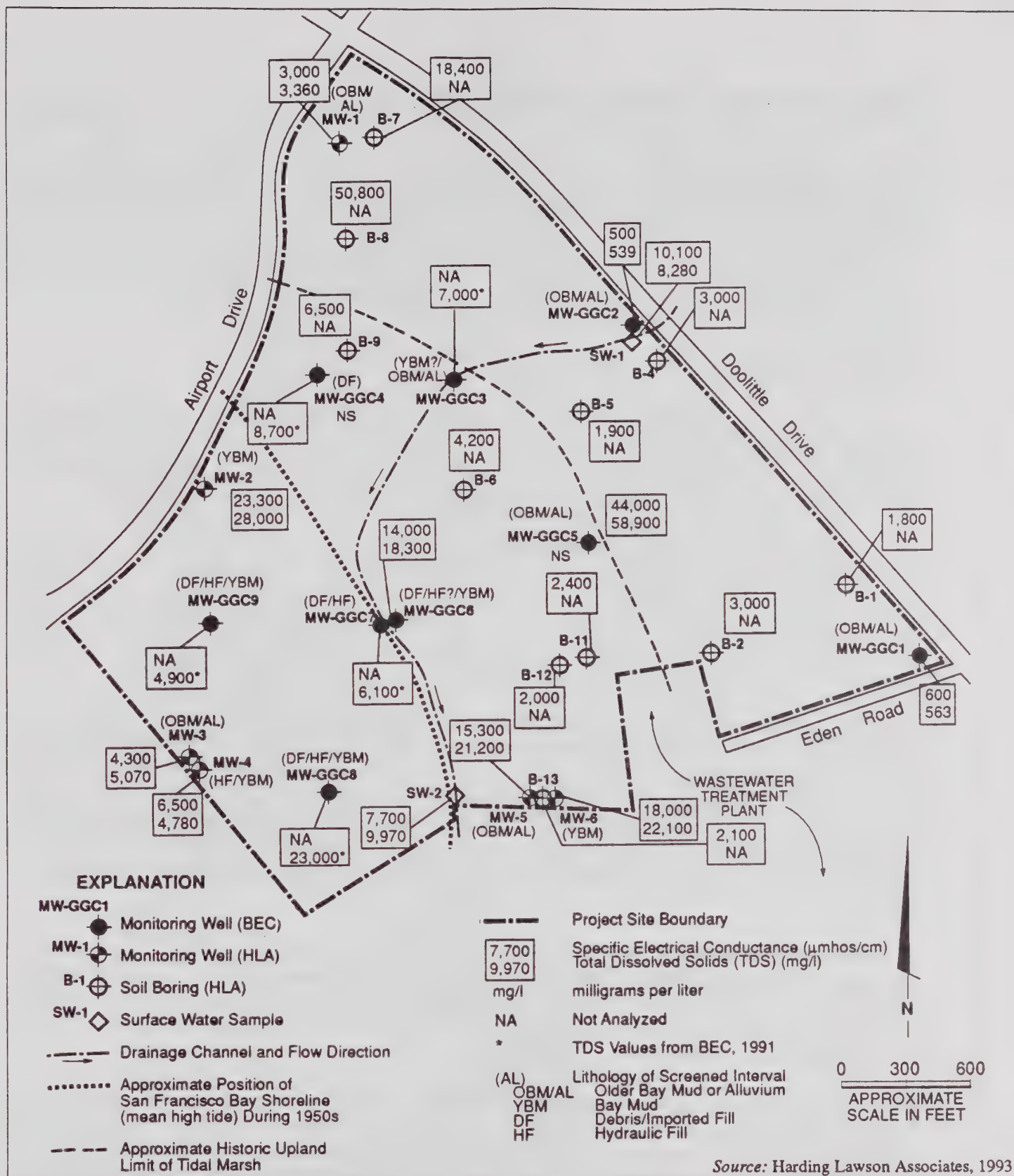


Figure 3.2.4.6-3

**FIELD CONDUCTIVITY AND TDS DISTRIBUTION MAP
GALBRAITH GOLF COURSE, OAKLAND, CALIFORNIA**

Data was obtained from documentation at the California Department of Water Resources (CDWR), the San Francisco Bay Regional Water Quality Control Board (Oakland Office) and from published data provided by the Alameda County Flood Control and Water Conservation District (ACFCWCD) and the Port of Oakland. Well survey data for 15 on-site wells and 81 off-site wells in the vicinity of the Galbraith Golf Course are shown on Figure 3.2.4.6-4 and presented in Tables D-1 and D-2 in Appendix D. According to ACFCWCD (1988), additional wells exist within this area, but no data were readily available.

GROUNDWATER QUALITY

The majority of the groundwater in the East Bay Plain area is a bicarbonate type containing calcium and sodium as the predominant cations. Total dissolved solids (TDS) concentrations are generally between about 300 to 1,000 milligrams per liter (mg/l). Groundwater quality is generally suitable for most uses, although high TDS concentrations can limit industrial and domestic uses (ACFCWCD 1988).

Water quality problems affecting shallow aquifers (100 feet deep or less) in the area include high concentrations of nitrates, salt water, and contamination from fuel or toxic waste releases. Shallow aquifers along the bayshore in San Leandro and San Lorenzo and in the Merritt Sand in Oakland and Alameda have been subject to salt water intrusion. Toxic substances that have been introduced to shallow aquifers in this area include petroleum products, liquids containing lead and chromium, and organic compounds such as acetone and benzene (ACFCWCD 1988).

Analytical results from groundwater samples collected from the 15 on-site wells and grab groundwater samples from 11 soil borings show that the shallow groundwater at the site is brackish to saline, and therefore not a potential drinking water source according to RWQCB criteria (HLA 1993 unpublished data). Groundwater samples from the northeast corner of the site did not exceed these criteria. However, the data suggest that shallow groundwater or "leachate" within the debris fill is significantly fresher than groundwater within the underlying bay mud and alluvium. This relationship may result from the infiltration of rainwater and irrigation water from the overlying golf course (HLA 1993 unpublished data).

Petroleum hydrocarbons have been found in groundwater in the southern portion of the site. Total petroleum hydrocarbons (TPH) as gasoline, diesel, and motor oil were detected in grab groundwater samples from 14 soil borings and some monitoring wells at concentrations ranging from below detection levels (at 50 $\mu\text{g/l}$) to 44,000 $\mu\text{g/l}$, below detection levels to 45,000 $\mu\text{g/l}$, and 16 to 420,000 $\mu\text{g/l}$, respectively (see Appendix D).

These grab groundwater samples from the soil borings appear to be representative of "leachate" water, which exists at the base of the landfill debris overlying bay mud deposits. Although the source of the petroleum hydrocarbons may be associated with landfiling activities both on site and off site, other potential sources have not been evaluated (e.g., a nearby former automobile junk yard or potential sources at the adjacent wastewater treatment plant).

The lateral extent of petroleum hydrocarbons in shallow groundwater in this area has not been fully delineated. Petroleum hydrocarbons may be present in shallow groundwater off site beneath the wastewater treatment plant property, an area which is also believed to have been part of landfiling operations by the City of San Leandro in the 1950s. Although grab groundwater samples collected from



soil borings (B-18 and B-19) adjacent to the drainage channel contained relatively high concentrations of petroleum hydrocarbons, groundwater that may be seeping into the channel does not appear to be degrading water quality in the channel. This conclusion is based on surface water data collected at locations where surface water flows onto the site and off the site; samples from both locations contained very similar concentrations of petroleum hydrocarbons (HLA, unpublished data). Relatively low concentrations of petroleum hydrocarbons detected in groundwater from wells screened in underlying bay mud and alluvium suggest that downward migration may have occurred; however, additional sampling rounds are required to verify their presence or absence in these wells.

Relatively high concentrations (i.e., above federal or state Maximum Contaminant Levels [MCLs]) of constituents including barium, chloride, nitrate, and trichloroethylene (TCE) were detected in some on-site wells. Halogenated volatile organic compounds (VOCs) were detected in groundwater from two on-site wells indicating that isolated plumes of contaminants may be present within groundwater underlying the site. Concentrations of TCE and cis-1,2-dichloroethene in groundwater samples from Well G31a suggest that a source of industrial solvents is present near or upgradient of the eastern boundary of the site (BEC 1991; HLA 1993 unpublished data).

Several sites within 1/4 mile have been documented to contain toxic substances in the shallow groundwater (Tables D-1 and D-2, Appendix D). Groundwater contaminants include volatile organic carbons (VOCs; e.g., TCE) and metals that exceed California drinking water standards (Applied Geosciences 1989; Kennedy/Jenks Engineers 1985). Toxic chemicals may have or may be migrating onto the Galbraith Golf Course from one or more of these nearby sites (i.e., TCE detected in Well G31a).

Surface Water

HYDROLOGY

The Galbraith Golf Course was constructed in 1965 on a capped landfill site. Prior to the filling of the site, it was a marshland and tidal flat subject to flooding, from freshwater drainage mixed with saline tidal flow. During the filling of the site, the freshwater was channeled and a tidal gate was installed, which created a separation between the freshwater and the tidal flow water. A recent site visit (May 18, 1994) determined that the tidal gate is not functioning properly and an undetermined amount of mixing of freshwater and tidal flow water presently occurs in the drainage channel. Most unchanneled surface water at the site (except at extreme north and west portions) drains vertically into the landfill cover material because of the high permeability of the thin soil covering and laterally to manmade drainage channels in the central portion of the golf course (Aquascape 1990). These drainage channels flow to a single drainage channel that discharges into San Francisco Bay, south of the site. Surface water from small areas in the extreme northern and western portions of the Golf Course drains south toward the adjacent Metropolitan Oakland International Airport and is pumped into the bay by Pump House 4 (ESA 1991). Current topographic elevations on the site range from 3 feet to 20 feet above mean sea level. This disposal site receives an average annual rainfall of 19 inches. The mean annual volume of runoff is approximately 13 acre-feet (ESA 1991).

FLOODING

The site is on areas of artificial fill placed into the Bay. For this reason there have been no significant historical flooding problems. Some ponding of runoff may occur along the northern boundary of the

Galbraith Golf Course (adjacent to Doolittle Drive) where depressed troughs exist. The depth of water in these troughs could not exceed 2 to 3 feet without overflow onto the Golf Course and the central drainage channel (ESA 1991).

WATER QUALITY

Two surface water samples were obtained by HLA (1993 unpublished data) near the upstream and downstream terminus of the on-site drainage channel that bisects the site (Figure 3.2.4.6-3). The surface water samples indicated the presence of levels of hydrocarbons, volatiles, metals, and analytes slightly above detection limits. The surface water sample from downgradient sampling station SW-2 generally had lower concentrations of these analytes than the surface water sample from the upgradient station SW-1. None of the samples exceeded regulatory action levels.

The runoff from the golf course may periodically be contaminated with fertilizers, herbicides, and pesticides (ESA 1988a); however, analytical data from surface water samples from SW-1 and SW-2 does not indicate that there is a significant problem with pesticides or nitrates, an active component of fertilizers.

3.2.4.7 Port/Landfill

The site is a paved terminal yard, supported on piles in the Oakland Inner Harbor. It is located in the Oakland Inner Harbor area; Water Resources are discussed in section 3.2.3.

3.2.4.8 Montezuma Wetlands

Groundwater

The following discussion is based on a technical report prepared by Levine-Fricke (1992) for the Montezuma Wetlands site. The report presents the results of groundwater investigations conducted to measure hydraulic conductivity, groundwater elevations, groundwater quality, and tidal fluctuations in groundwater levels. The report also characterizes surface waters in the Montezuma Wetlands area.

HYDROGEOLOGY

The Montezuma Wetlands site is located on the eastern margin of Suisun Marsh and the deltaic juncture of the Sacramento and San Joaquin rivers with Suisun Bay (see Figure 2.7.8-1). It comprises approximately 2,200 acres of tidal marshland slough and transitional upland area.

Shallow groundwater levels at the site range between 0.2 feet and 3.4 feet below the ground surface. Shallow groundwater elevations at the site typically remain below about -2.5 feet mean sea level, with some elevations as low as -7.58 msl. The groundwater elevation of the site increases gradually from the Montezuma Slough eastward toward the gently rolling Montezuma Hills. Monitoring well data indicate a consistent hydraulic gradient from the Sacramento River and Montezuma Slough to shallow groundwater.

The majority of shallow sediments at the site consist of fine-grained silts, clays, and organic soil (peat), which generally have low horizontal hydraulic conductivities (e.g., about 10^{-5} cm/sec). Vertical

permeabilities are expected to be lower than the horizontal conductivities. Given these low hydraulic conductivities, it is thought that the rate of recharge is lower than the rate of evaporative losses. Monitoring well data indicate that groundwater levels over most of the site are not subject to the tidal fluctuations of the Montezuma Slough and Sacramento River.

Water-bearing silty sands are present at the site within approximately 500 feet of the Sacramento River. Horizontal permeability is higher within these sandy sediments than within other sediments elsewhere at the site. Vertical permeability is thought to be low; monitoring well data indicate that the sandy sediments are overlain by silty clay. Monitoring well data indicate the potential for significant recharge into this shallow groundwater from the Sacramento River. Groundwater levels in the sandy sediments vary according to the tidal fluctuations of the Sacramento River.

Deeper water supply wells in the vicinity of the site generally range between depths of 60 and 200 feet below ground surface. Differences in water quality between shallow and deeper groundwater indicate that these two water-bearing units are hydraulically separated.

GROUNDWATER QUALITY

On-site shallow groundwater is brackish and unsuitable as a potential drinking water source or for agricultural purposes, and its potential beneficial uses are limited. Groundwater quality data collected in October 1990 indicate that shallow groundwater at the site contains high concentrations of total dissolved solids (up to 25,000 mg/l), sodium (up to 7,000 mg/l), and chloride (up to 12,000 mg/l).

Water quality data from two local supply wells showed that the deeper groundwater contains relatively low concentrations of TDS (generally below 700 mg/l). Current beneficial uses of deeper groundwater in the vicinity include domestic, industrial, and agricultural water supply.

Surface Water

HYDROLOGY

The two major surface water bodies in the vicinity of the site are the Sacramento River along the southern site boundary and the Montezuma Slough along the western site boundary. Quality and salinity in these waters vary considerably with tides, season, annual rainfall, delta outflow, and operation of the Montezuma Salinity Control Structure. In general, the less saline Sacramento River water is high in nutrients and TSS, and most of the annual volume and sediment loading occurs during major winter storm events.

Surface water salinity levels in the immediate vicinity of the site have been affected by the recent installation of the Montezuma Salinity Control Structure. This structure was designed to capture less saline Sacramento River water at ebb tide and tidally pump it to the more saline western Suisun Marsh, to meet state water quality control standards. A set of Contra Costa Water District drinking water supply intakes are located at Mallard Slough across the Sacramento River, about 3.5 miles to the southwest.

Two small watersheds adjacent to the site with a combined area of about 3,100 acres drain intermittently into the site from the Montezuma Hills to the east. The Montezuma Hills drainage area east of Collinsville Road covers approximately 1,730 acres and drains into the site via Clank Hollow. The

uplands area west of Collinsville Road, adjacent to the site, covers approximately 1,370 acres. These watersheds support agricultural activities including sheep and cattle grazing and feed production. During major winter storms considerable runoff reaches the site, providing moderate quantities of nutrients and TSS.

Surface water in the interior of the site results from rainfall runoff and groundwater discharge. Some of this water collects in seasonal ponds during the winter and spring.

FLOODING

Potential sources of flooding include daily tidal fluctuations; storm runoff from upland drainage areas; and flooding from the Sacramento-San Joaquin rivers and delta system. The site currently is drained through a network of shallow channels connected to two float-activated pumping stations.

Upland areas that may contribute runoff to the site include a total drainage area of about 3,300 acres, approximately 1,730 acres of which include the Montezuma Hills that drain through Clank Hollow, and 1,370 acres of which are uplands adjacent to the site, east of Collinsville Road. Clank Hollow and adjacent upland storm runoff during the rainy season accumulate within the low-lying areas of the site adjoining the principal drainage pathways. During relatively large storm events, runoff from Lucol Hollow may drain onto the site.

The site currently is protected from the effects of daily tidal flooding from the Montezuma Slough and the Sacramento and San Joaquin rivers by a manmade levee system. This levee, which extends along the western and southern margins of the site, forms the eastern bank of Montezuma Slough and the northern bank of the Sacramento River.

Deltaic flooding of the site and adjacent areas could occur through overtopping or breaching of the perimeter levee, or from overtopping at other topographic low points. A review of elevations at the site indicates a potential avenue of flood waters from the northeastern corner of McDougal Cut and from the adjoining property on Birds Landing Road at the northwest corner of the site. However, the potential for overtopping the levee is minimized by the water storage capability of Suisun Bay and Sherman Island, located to the south and southeast of the site, respectively.

WATER QUALITY

Data regarding surface water quality were obtained by Levine-Fricke at the Montezuma Wetlands site and by the CDWR at five monitoring stations in the project vicinity. Water quality data are compared with the Water Quality Objective Limits (WQOLs), established by the State for the protection of saltwater aquatic life, and with the MCLs, established by the State for the protection of human health in drinking water supplies (see tables 3.2.1.1-1 and 3.2.1.3-1).

Total and dissolved concentrations of inorganic elements detected (arsenic, cadmium, chromium, copper, lead, mercury, and zinc) were all below their respective MCLs, except for one sample for total lead collected from a CDWR monitoring station located off-site in Suisun Bay near Martinez. Concentrations of total and dissolved arsenic, cadmium, chromium, and mercury levels were below WQOLs. Both total and dissolved concentrations of copper, lead, and zinc exceeded WQOLs at CDWR monitoring stations in the project vicinity. However, since laboratory detection limits for copper, lead, and zinc were greater than the WQOLs, it is not known whether samples collected from the Montezuma Wetlands site exceeded WQOLs for these elements.

3.3 GEOLOGY, SOILS, AND SEISMICITY

3.3.1 Regional

Project dredging and disposal alternatives are located within the general region of the San Francisco Bay, an irregular group of connected water bodies (including Suisun and San Pablo bays) totaling approximately 400 square miles. Development of the water front and landfilling along the margins have reduced the original bay from some 700 square miles to its current size. About 85 percent of the water area is less than 30 feet deep, ranging to a depth of greater than 340 feet at the mile-wide Golden Gate, where strong tidal currents from the open ocean continually scour the bedrock (Oakeshott 1978).

The bay area is located within the Coast Ranges Geomorphic Province of California, which is characterized by a system of northwest-trending longitudinal mountain ranges and valleys that are controlled by faulting and folding. The bay itself was formed in the Late Pleistocene due to structural downwarping. Flooding of the area occurred several times with the rise and fall of sea level resulting from numerous interglacial periods throughout the Pleistocene. Centrally located on the west coast of California, the bay separates the low hills of the San Francisco and Marin peninsulas of the southern and northern Coast Ranges, respectively. The Berkeley Hills lie to the east. To the north, San Pablo Bay fingers out into Petaluma, Sonoma, and Napa valleys. Suisun Bay and the Carquinez Strait extend into the Central Valley to the northeast. South of the bay the structural depression extends into Santa Clara and San Benito valleys (Norris and Webb 1976).

The geology of the area is characterized by three structural blocks roughly separated by the active San Andreas and Hayward faults, both right-lateral slip faults of the San Andreas fault system. The Hayward fault zone branches off the San Andreas south of the bay and extends along the base of the Berkeley Hills to San Pablo Bay or farther. East of the Hayward fault lies the Berkeley Hills block, composed of Cretaceous marine sedimentary formations overlain by Tertiary sedimentary and volcanic rocks. The San Andreas rift zone lies west of the Bay but generally traverses both San Mateo and Marin counties to the south and north, respectively. The San Andreas fault separates the San Francisco-Marin block on the east from the Point Reyes-Montara block on the west. As the northernmost land extension of the larger Salinian structural block, the Point Reyes-Montara block is lacking the occurrence of the Franciscan Formation as basement or surface outcrops, which characterizes the San Francisco-Marin and the Berkeley Hills blocks to the east (Oakeshott 1978).

Other active faults associated with the San Andreas system that lie east of the Hayward Fault zone include the Calaveras, Greenville, Ortigalita, and Concord-Green faults. The Pilarcitos fault parallels the San Andreas to the west and is thought to represent a former extension of the San Andreas that subsequently shifted to its present course. This fault has been inactive throughout the Quaternary (Norris and Webb 1976).

Sediment chemistry data gathered from several in-Bay studies were summarized by Long and Markel (1992). Data collected from the central basins of San Pablo Bay, Central Bay, and South Bay were compared with data collected in the peripheral areas (i.e., harbors, ship channels, marinas, and industrial waterways). The data, presented in Table 3.3.1-1, indicated that the peripheral harbors and channels had higher contaminant concentrations than the basins. Among the three basins, mean concentrations were somewhat similar. Long and Markel (1992) further evaluated the data by calculating mean concentrations

for all basin samples combined and all peripheral samples combined to observe trends among specific contaminants (Table 3.3.1-2). In this analysis, mean contaminant concentrations in the peripheral areas were again observed, in general, exceeding mean concentrations in the basins. Silver, copper, lead, the sum of seven PAH compounds, total DDT, and total PCB tended to be higher in concentration in the periphery than in the basins. The mean concentrations of chromium and the sum of 18 PAH compounds, however, were observed at higher concentrations in the basins than in the peripheral areas. Mercury and cadmium were relatively similar in concentration between the basins and the peripheral areas. From these chemical data, Long and Markel (1992) inferred that the average sediment toxicity may be higher in the peripheral harbors and channels than in the basins but pointed out that the distribution of toxicity is subject to small-scale patchiness (Long and Markel 1992).

Table 3.3.1-1. Mean Concentrations of Selected Toxicants in Surficial Sediments from Three Basins and Four Peripheral Areas of San Francisco Bay
(from Long et al. 1988)

	BASINS			PERIPHERY			
	<i>San Pablo Bay</i>	<i>Central Bay</i>	<i>South Bay</i>	<i>Oakland Inner Harbor</i>	<i>Islais Creek Harbor</i>	<i>Redwood Creek</i>	<i>Richmond Harbor</i>
Trace Metals (ppm, dry weight)							
Mercury	0.45	0.35	0.65	0.57	1.30	0.42	0.40
Cadmium	0.71	0.79	1.44	0.67	2.23	2.47	0.65
Copper	45	33	33	72	78	66	36
Lead	32	34	30	97	102	87	39
Chromium	280	81	84	ND	140	91	123
Silver	0.45	0.72	0.57	ND	4.69	ND	ND
Organic Compounds (ppb, dry weight)							
Total PAH*	2600	3900	2700	7200	62700	ND	ND
Total DDT	9	16	3	120	3	ND	260,700
Total PCB	27	71	28	361	305	ND	ND

Notes: ND = No Data
* Sum of 18 individual PAH

3.3.2 Oakland Harbor

3.3.2.1 Geology

Oakland Harbor was constructed in a natural depression or drainage area in the broad low-lying Bay plain bordering the eastern shores of San Francisco Bay. Elevations on the Bay plain in the vicinity of the harbor area vary from sea level to about 30 feet, gradually rising to the base of the Berkeley Hills to the east. Materials beneath the Bay plain consist of thick, unconsolidated sediments of marine and continental origin deposited during Pleistocene and Recent geologic time. Bedrock underlying the sediments is

Franciscan sandstone and shale, which forms the eastward dipping floor of a trough-like depression created by regional warping and faulting, some time before the Pleistocene. The trough was nearly filled with sediments, some derived from the surrounding hills and some marine. The lower several hundred feet of these deposits in the part of the Bay that includes the harbor have been called the Alameda formation. The Alameda formation, which consists of yellowish-brown sandy clay, was dissected and eroded prior to deposition of the Merritt sand and the Temescal formation. The Merritt sand is a fine-grained, clean-to-moderately-clayey, beach sand deposit, while the Temescal formation is a largely yellowish sandy gravel and silt-sand-clay mixture. Both are exposed in downtown Oakland east of the project area. These deposits were in turn eroded, and the deeper channels filled with soft, unconsolidated marine clays and silts (Bay Mud) as the sea level rose, partly because of the melting of the ice after the last glacial period, and partly because of continued subsidence and tilting. In the project area, the older formations are over 200 feet thick, while the thickness of the Bay Mud varies from a few feet along the northeast side of the outer harbor area to over 50 feet in the western reaches.

Table 3.3.1-2. Overall Average Concentrations ($\pm$ Standard Deviations) of Selected Toxicants and Numbers of Samples Tested in Basin and Peripheral Areas (from Long et al. 1988)

<i>Chemical</i>	<i>All Basins</i>	<i>All Periphery</i>
Trace Metals (ppm, dry weight)		
Mercury	0.45 $\pm$ 0.73, n = 396	0.52 $\pm$ 0.63, n = 701
Cadmium	0.94 $\pm$ 1.25, n = 256	1.10 $\pm$ 1.13, n = 743
Copper	36 $\pm$ 22, n = 376	62 $\pm$ 73, n = 503
Lead	32 $\pm$ 27, n = 461	69 $\pm$ 371, n = 853
Chromium	108 $\pm$ 129, n = 140	80 $\pm$ 70, n = 256
Silver	0.51 $\pm$ 0.51, n = 148	1.63 $\pm$ 1.83, n = 188
Organic Compounds (ppb, dry weight)		
Σ 18 PAH*	2700 $\pm$ 2700, n = 11	2480 $\pm$ 39,100, n = 10
Σ 7 PAH**	1600 $\pm$ 1400, n = 77	12,200 $\pm$ 18,700, n = 24
Total DDT	9 $\pm$ 15, n = 75	190 $\pm$ 380, n = 78
Total PCB	45 $\pm$ 35, n = 37	287 $\pm$ 245, n = 15

Notes: * Sum of 18 individual PAH compounds (from Figure 72, Long et al. 1988)

** Sum of seven individual PAH compounds (from Table 29, Long et al. 1988).

3.3.2.2 Sediment Quality

A sediment characterization program was devised for the deepening and widening of Oakland Harbor (Phase III) to -42 feet MLLW early in 1990. The size of the program and the intensity of the sediment sampling design necessitated the phasing of field activities to occupy different portions of the Harbor. In March 1990, 19 stations were occupied in Outer and Inner Oakland Harbor berths where sediment core samples were collected for physical, chemical, and toxicological testing. Berths 25, 32, 33, and 34 were sampled in Oakland Outer Harbor, while berths 38, 60, 61, 62, and 63 were sampled in Oakland Inner Harbor. Sediment collections in June and September of 1990, termed Phase IIIA and IIIA Repeat,

focused on the Inner portion of Oakland Harbor and included the Inner Harbor Turning Basin Wings and maneuvering areas. In November of 1990, Phase IIIB field collections were performed in Oakland Outer Harbor and a portion of the entrance to Oakland Inner Harbor. Finally, the Oakland Intensive study was performed in the spring of 1993, involving portions of the Inner and Outer Harbor (see figures 2.4-1 through 2.4-3). It should be noted that the Turning Basin wings were sampled and tested several times between 1988 and 1992. These data are summarized in tables A-7, A-8, and A-9.

The sediment characterization for each phase of the program included geologic descriptions of sediment cores, analysis of conventional parameters (grain size, total organic carbon, total volatile solids, oil and grease, and total petroleum hydrocarbons), butyltins, and EPA priority pollutants (metals, pesticides, polycyclic aromatic hydrocarbons [PAH], and polychlorinated biphenyls [PCBs]). Toxicological testing involved the exposure of sensitive aquatic species to the solid and suspended-particulate phases of the proposed dredged material. Suspended-particulate phase bioassays assess potential biological effects of suspended sediments in the water column during dredged material disposal. Solid phase tests evaluate the potential toxicity of redeposited sediments in the marine environment after disposal. Additional biological testing in the form of bioaccumulation tests were performed in which marine organisms were exposed to dredged material for 28 days. After this time, the tissues of exposed organisms were analyzed for the EPA priority pollutants, PAHs, and PCBs. The results of all of these tests were used to determine material suitability for unconfined, open-water disposal. It is important to note that suitability decisions differ somewhat between ocean and in-Bay disposal (see sections 4.4.2 and 4.4.3). Suitability for ocean disposal is regulated by the ocean disposal testing manual (EPA-503/8-91/001, see Appendix A paragraphs 65 and 66), while suitability for in-Bay disposal is regulated by PN 93-2 (see Appendix A paragraphs 68 and 69). The differences in suitability determinations are largely due to comparisons to different reference sediments. The results of the sediment characterization program are described in Battelle (1992a, 1992b, 1992c, 1992d) and are summarized in Appendix A. This section primarily summarizes the sediment chemistry results (conventional and contaminant) and, secondarily, toxicity testing results to assess the quality of Oakland Harbor sediments overall.

Oakland Harbor sediments display wide-ranging characteristics in texture and contamination levels. Ranges in conventional and contaminant variables (determined according to 1991 Green Book protocols) are presented in detail in Appendix A (tables A-1, A-2, and A-3) and are not described here. As a means of assessing general sediment character, mean concentrations of these parameters are presented in Table 3.3.2.2-1 for four sampling zones mentioned above (i.e., Inner Harbor, Outer Harbor, Inner Harbor Turning Basin Wings, and Berths). It is important to note that the mean concentrations are unweighted for the volume of sediment represented by each sample. Sediments collected along the berths were predominately composed of sand (74 percent), while sediments from the other areas were typically composed of near-equal portions of sand and fines (silt and clay) (i.e., 44 percent sand and 56 percent fines on average). Sediments containing the highest mean percentages/concentrations of clay, total volatile solids (TVS), oil and grease, and total petroleum hydrocarbons (TPH) were located in the Inner Harbor Turning Basin Wing samples. These sediments, overall, consistently demonstrated maximum mean concentrations of the following contaminants among all samples: copper, lead, nickel, selenium, zinc, butyltins, total DDT, total PCBs, and PAHs, both low- (LPAH) and high- (HPAH) molecular weight. Maximum mean concentrations of mercury, arsenic, and cadmium were present in the Inner Harbor. The highest mean chromium value was noted for the Berth samples.

Chlorinated pesticides other than DDTs were, in general, detected infrequently. When detected, pesticides were predominantly found in the Inner Channel and along the Berths, and less frequently in

Table 3.3.2.2-1. Mean Conventional and Contaminants Data for Proposed Oakland Harbor Dredged Sediments (summarized from Appendix A tables)

<i>Parameter</i>	<i>Inner Harbor¹</i>	<i>Outer Harbor</i>	<i>Turning Basin</i>	<i>Berths</i>
Conventionals				
TOC (%)	0.5	0.55	0.62	0.28
TVS (%)	3.32	4.07	5.14	2.44
Gravel (%)	0.18	0	0.12	0
Sand (%)	46	42	44	74
Silt (%)	25	26	19	10
Clay (%)	28	32	37	16
Oil and Grease (ppm, dry)	54	98	128	101
TPH (ppm, dry)	41	55	98	96
Metals (ppm, dry weight)				
Arsenic	8.2	6.9	7.8	5.1
Cadmium	0.30	0.27	0.29	0.16
Chromium	289	339	359	368
Copper	41	39	49	23
Lead	22	21	30	16
Mercury	0.308	0.226 ²	0.303	0.121
Nickel	80	94	97	68
Selenium	0.19	0.14	0.23	0.16
Silver	0.26	0.21	0.28	0.16
Zinc	101	106	121	65
Organics (ppb, dry weight)				
Butyltins				
Tributyltin	12	2.8	26	11
Dibutyltin	7.2	1.3	15	2.3
Monobutyltin	1.9	1.1	3.2	2.7
Chlorinated Pesticides & PCBs³				
Total DDT	4.5	4.6	6.3	3.0
Total PCBs	74	29	102	81
LPAHs				
Total	100	167	215	196
HPAHs				
Total	1119	978	2091	1139

- Notes:**
1. Inner Harbor mean concentrations influenced by two composite samples (I-C29 and I-C30) that have elevated levels of most contaminants with respect to other Inner Harbor composites
 2. Composite AC-3
 3. Other pesticides were generally not detected with the exception of berthing areas.

Undetected concentrations were included in calculations of the mean as the detection limit. "Ux" values noted in Appendix A tables (undetected but concentration not shown) were not included in the calculation of the mean. These values occur rarely (LPAHs and HPAHs:I-T5; DDTs:COMP I-C1-A, COMP OB-1).

Concentrations are not volume-adjusted means.

the Outer Harbor. Low levels of pesticides were detected in 85 percent of the Berth samples (see Appendix A).

To determine whether Oakland Harbor sediments demonstrate contaminants levels above or below Bay-wide concentrations, data were compared to information summarized by Long and Markel (1992). For those selected contaminants provided in Table 3.3.1-1, the mean concentrations calculated for the Oakland Harbor samples (including mercury, cadmium, lead, silver, total PAH, and total DDT) generally fall well within Central Bay averages. Copper and total PCBs concentrations, although slightly in excess of Central Bay averages, are lower than those mean concentrations from peripheral areas in San Francisco Bay (see Table 3.3.1-1). The only contaminant that demonstrates consistently higher measurements in comparison to Bay-wide average concentrations is total chromium. Oakland Harbor mean chromium concentrations range from 289 ppm to 368 ppm, while the Central Bay mean chromium concentration from Long and Markel (1992) is 81 ppm. Mean concentrations of chromium in Islais Creek Harbor and Richmond Harbor are 140 ppm and 123 ppm, respectively (Long and Markel 1992). The notably high mean chromium concentrations in Oakland Harbor sediments are not unexpected given the large percentage of clean Merritt sands incorporated in these samples. Merritt sands are derived from native serpentinite formations that are themselves enriched in chromium and magnesium. Chromium, bound in sediments, is not readily available. Although, in this comparison, Oakland Harbor sediments were found to be generally comparable in contaminant levels to other portions of San Francisco Bay, the toxicity of the Oakland Harbor sediments is of greater importance in the dredged material evaluation process.

The results of toxicity, bioaccumulation, leachate, elutriate, and other tests on the Oakland Harbor sediments, which were used to make decisions about the suitability of these sediments for aquatic and upland/wetland disposal, are discussed in section 4.4.2. The suitability of these sediments for the various disposal options under consideration is summarized in section 2.4.

Additional bioaccumulation tests using flatfish and mollusks were conducted on Oakland Harbor sediments at the Waterways Experiment Station (WES) of the Corps, Vicksburg, Mississippi (McFarland et al. 1993). Four composite samples were analyzed using both bedded and suspended-particulate phase test conditions. These composites included Inner Harbor samples (I-C1 through I-C18); Outer Harbor samples (O-C1 through O-C13); a reference sample consisting of the top 2 cm of material collected from a location on Berkeley Flats; and a composite sample collected in the wings of the Inner Harbor. Samples were not collected along the berths for this study. Although the results of these tests were not used to make suitability decisions for open-water disposal, they provide confirmatory information concerning the potential bioavailability of contaminants present in Oakland Harbor sediments. In addition, the Berkeley Flats reference sediment was chosen to represent the present "condition" of Central Bay surficial sediments and hence it provides a relevant basis for comparison.

Based on bulk sediment chemistry results, WES determined that PAHs, some metals (cadmium, chromium, mercury), tributyltin, dibutyltin, and the pesticide, Aroclor 1254, were the primary contaminants of concern for these samples. In general, contaminant concentrations in Inner Harbor sediments, which were composed predominantly of sand, were generally lower than those sediments collected in Berkeley Flats. The exceptions to this were chromium and dibutyltin, which were significantly higher in Inner Harbor sediments than the reference sediment. Outer Harbor sediments were generally on par with Berkeley Flats sediments, and the Turning Basin Wings sediments were generally the most contaminated among all samples. The results of the bioaccumulation tests revealed that the

bioavailability of contaminants present in Inner and Outer Harbor sediments were generally not substantial. Although Outer Harbor and Berkeley Flats reference sediments were similar in terms of relative contaminants levels, contaminants in the Outer Harbor sediments are less bioavailable (due to the character of the material) than those in Berkeley Flats sediments. Contaminants in the Turning Basin Wings sediments (PAHs, in particular), however, are highly bioavailable to aquatic organisms. The Inner Harbor Turning Basin Wing sediments, in the dredged material evaluation process, were deemed unsuitable for unconfined, open water disposal.

3.3.2.3 Seismicity

Oakland Harbor lies in a very active seismic area. The Hayward Fault, which has undergone historic surface rupture and fault creep, lies about 5 miles to the east, while the San Andreas Fault is located about 12 miles to the west. The major faults are accompanied by many smaller, usually sub-parallel, faults. The harbor area may be subjected to earthquakes up to Richter Magnitude 7.5 - 8.5 from the San Andreas or Hayward faults, which could result in vibration-induced sliding of the channel margins. The possibility of the occurrence of other damaging earthquake-caused effects such as surface rupture is remote. The reaction of buildings and other structures flanking the channel will depend on how they are supported. A 10- to 12-foot-high tsunami with a recurrence interval of 200 years is possible in the harbor area (Ritter and Dupre 1972). Garcia and Houston (1975) have predicted an 11-foot wave height for a 100-year recurrence interval and a 19-foot wave height for a 500-year recurrence interval.

3.3.3 Disposal Site Options

The first three sections summarize existing sediment quality conditions at the three potential aquatic disposal sites. Sediment quality conditions at these sites are assessed using conventional and contaminant (i.e., metals and organics) chemistry data and, if available, toxicity testing results.

3.3.3.1 Ocean Section 102

Sediment quality data were collected from Study Area 5 and the Navy Ocean Disposal Site (NODS) (Section 103) in separate studies conducted in 1990 and 1991. It should be noted that the Ocean Section 102 Site, Alternative Site 5, and the NODS, as referenced, are the same geographically. The sediments within Study Area 5 consist mainly (76 percent) of silt-sized particles (Table 3.3.3.1-1) (EPA 1993a). Similar grain sizes were obtained in surveys of the NODS, which is located within Study Area 5 and corresponds to the Ocean Section 102 site, as stated above. Average values of 74 percent silts and 19 percent clays were obtained for NODS sediments (U.S. Navy 1993). However, average grain sizes obtained throughout the whole of Area 5 had a higher fraction of sand (13 percent) and somewhat lower clay fraction (10 percent) than the NODS. Values obtained for other parameters that are used to assess the organic composition of the sediment, were 1.4 percent carbonate, 2.7 to 3.8 percent total organic carbon (TOC), 3.5 percent carbon, and 0.45 percent nitrogen.

Average and ranges of metals concentrations obtained for Area 5/NODS sediments during Navy 1990 and EPA 1991 surveys are presented in Table 3.3.3.1-1 (EPA 1993a). For the most part, metal concentrations were not unusually high or suggestive of contamination from past waste disposal in the region, or from other anthropogenic sources. Concentrations were as expected for natural or background levels (EPA 1993a). Mercury levels tended to be high, having an average concentration over 11 samples of 0.20 parts per million (ppm). This is likely due to weathering of local source rocks (U.S. Navy 1993).

Table 3.3.3.1-1. Conventional Parameters and Detected Contaminant Concentrations for Sediments Collected at the Proposed Ocean Section 102 Site

<i>Analyte</i>	AREA 5		OCEAN REFERENCE SITE ¹	
	<i>Mean</i>	<i>Range</i>	<i>Mean</i>	<i>Range</i>
Conventionals				
Total Organic Carbon (%)	3.28	2.8 - 3.9	0.68	0.57-0.79
Total Solids (%)	30.9	21.7 - 43.9	--	--
Average phi size	5.33	3.95 - 5.78	--	--
Gravel (%)	1.2	0.3 - 6.4	1.69	0-6.77
Sand (%)	13.0	2.1 - 37.1	53	45-60
Silt (%)	76.1	48.5 - 90.3	28	25-35
Clay (%)	9.9	7.6 - 15.2	17	13-20
Carbonate (%)	1.4	1.2 - 1.6	--	--
C (%)	3.5	2.7 - 3.86	--	--
N (%)	0.45	0.34 - 0.49	--	--
C/N	9.07	8.85 - 9.25	--	--
Metals (ppm, dry weight)				
Arsenic	4.6	4.4-5.2	4.35	3.88-5.33
Cadmium	0.31	0.24-0.38	0.405	0.31-0.57
Chromium	149	127-168	223	192-255
Copper	41.9	19.8-62.5	22.0	20.3-23.9
Lead	10.4	9.6-12	8.4	6.8-9.6
Mercury	0.20	0.13-0.36	0.105	0.058-0.217
Nickel	92.2	77-115	67.4	63.5-70.0
Selenium	4.8	2.8-6.6	0.84	0.56-1.21
Silver	0.55	0.45-0.64	0.297	0.190-0.390
Zinc	111	91-147	83.1	76.3-91.4
Organics (ppb, dry weight)				
Lindane	11.3	7.5 - 15		

Note: 1. Ocean Reference Site (R-OS) from Battelle (1992a,b,c).

Sediments collected during the EPA 1991 surveys were analyzed for organic compounds including petroleum hydrocarbon, PAHs, pesticides, and PCBs. Hydrocarbons and other organic compounds were not detected in sediments collected from Study Area 5 during the Navy surveys. However, detection limits used were relatively high compared to analyses for other study areas within the region (i.e., lower analytical sensitivity). Values for other areas reflected an increase with depth in total organic carbon levels, and fine grain sizes, corresponding to sediment transport processes. Concentrations of DDTs followed a similar pattern. Other pesticides measured were generally below detection limits. However, the pesticide lindane was detected within Area 5; whereas, this compound was not found in samples for other study areas nearby. Total PCB concentrations, which were at or below the detection limit, tended to be relatively uniform throughout the most of the region, although elevated concentrations were observed near the 1000 m isobath (Study Area 3). This may be due to a localized input into this location. The PCB Aroclor 1221 had concentrations near the detection limit within Area 5. The distributions of organic compounds throughout the study region, including Area 5, generally reflected grain size and organic content distributions, rather than proximity to anthropogenic or source inputs (e.g., historical waste disposal) (EPA 1993a).

Table 3.3.3.1-1 also provides grain size and metals data for reference sediments collected at a location southwest of the Farallon Islands. These sediments were used in comparisons by the EPA and Corps to make suitability decisions of the project dredge site sediments for unconfined, open-water ocean disposal. The reference sediments were composed of more sand than the average Area 5 sediments (53 percent versus 13 percent). Lower mean concentrations of most metals (exceptions: cadmium and chromium) were measured in the ocean reference sediments than the Area 5 sediments. The relative differences in concentrations seem to correlate with differences in grain size distribution, which supports similar findings in the EPA study (EPA 1993a).

3.3.3.2 Alcatraz

The Alcatraz disposal site and the area adjacent to the site are used routinely as reference sediments for in-Bay dredged sediment characterization studies. Consequently, recent sediment contaminant chemistry and toxicity data are available for this area. The sediments discussed in this section were collected in 1990 for testing in four different Oakland Harbor dredged sediment sampling and testing projects. Surface sediments were collected within the boundaries of the disposal site (samples labeled "R-AC") and within 0.5 km of Alcatraz Island but beyond site boundaries (samples labeled "R-AM"). Each sample was a composite of sediments collected from at least four different sampling sites in the defined area. Conventional and contaminant chemistry results are presented in Table 3.3.3.2-1.

The data presented in these tables demonstrate the relatively high variability in conventional and contaminant chemistry measurements between samples collected at the Alcatraz disposal site itself. The high rate of disposal activity results in a heterogeneous substrate. Disposal site samples (i.e., R-AC samples) are generally elevated in most metals, oil and grease, TPHs, and PAHs. Total PAHs were measured as high as 36,830 ppb in disposal site sediments during the Berthing Areas characterization (Battelle 1992b). Pesticides and PCBs were generally not detected in disposal site and Alcatraz Island environs samples. However, sample R-AC reported in Battelle (1992b) did contain detectable concentrations of DDTs (total DDTs = 3.3 ppb) and low levels of some pesticides (qualified as estimates - "E"). It should be noted that sediments collected within the disposal site boundary during the Phase IIIB Oakland project were comparable in texture (dominated by sand) and contaminants levels to the Alcatraz Island environs samples, pointing to the heterogeneous character of disposal site sediments.

Table 3.3.3.2-1. Detected Conventional and Contaminants Data for Alcatraz Sediments

<i>Parameter</i>	BATTELLE 1993 ¹	BATTELLE 1992A ²		BATTELLE 1992B ³		BATTELLE 1992C ⁴	
	<i>R-AM</i>	<i>R-AC</i>	<i>R-AM</i>	<i>R-AC</i>	<i>R-AM</i>	<i>R-AC</i>	<i>R-AM</i>
CONVENTIONALS							
TOC (%)	0.78	0.05	0.19	0.43	0.11	0.94	0.07
Total Volatile Solids (%)	0.24	1.20	2.10	4.89	2.30	8.61	2.13
Gravel (%)	3	0	0	5	7	0	4
Sand (%)	94	98	91	61	90	15	91
Silt (%)	1	0	3	17	1	40	4
Clay (%)	2	2	6	17	2	45	1
Oil and Grease (ppm,dry)	41	7	0.7 U	115	1.3 U	92	13
TPH (ppm, dry)	12 U	5	8	110	1.3 U	78	0.60 U
METALS (ppm, dry weight)							
Arsenic	9.1	6.92	6.55	11.7	8.01	10.7	13.2
Cadmium	0.1 U	0.07	0.09	0.21	0.05	0.23	0.04
Chromium	190	171	156	414	136	229	121
Copper	11.5	10	12.4	32.2	11.7	56.1	11.4
Lead	15.2	14.7	14.4	23.1	13.8	24.4	11
Mercury	0.036	0.080	0.156	0.183	0.009	0.306	0.048
Nickel	42.3	37.6	40.7	80.4	51.8	104	38.8
Selenium	0.12 U	0.11 U	0.11 U	0.13	0.12 U	0.21	0.08 U
Silver	0.042	0.026	0.033	0.201	0.015	0.320	0.020
Zinc	36.8	34.1	37.7	78.2	32.3	115.3	35.4
ORGANICS (ppb, dry weight)							
Butyltins							
Tributyltin	0.8	1.0 U	1.1	0.8 U	0.8	19.4 B	1.0 B
Dibutyltin	1.2 U	1.1	1.0 U	0.7 U	0.6 U	4.2	1.6
Monobutyltin	1.3 U	1.0 U	1.0 U	1.3	1.0 B	1.0	0.6 U
Chlorinated Pesticides							
Alpha BHC	0.1 U	5.0 U	5.0 U	1.539 E	0.18 U	4.0 U	2.0 U
Delta BHC	0.1 U	5.0 U	5.0 U	0.176 JE	0.18 U	4.0 U	2.0 U
Lindane	0.07 U	5.0 U	5.0 U	0.768 E	0.18 U	4.0 U	2.0 U
Total DDT	0.5	5.0 U	5.0 U	3.33	0.70 J	4.0 U	2.0 U
B-Endosulfan	0.1 U	5.0 U	5.0 U	1.187 JE	2.0 U	4.0 U	2.0 U
Heptachlor	0.53 U	5.0 U	5.0 U	0.2 JE	0.5 U	4.0 U	2.0 U
LPAHs Total	1,372	187	374	10,215	158	979	46
HPAHs Total	3,757	571	1246	26,615	511	2,005	93

Notes:

1. Oakland Harbor Intensive Study
2. Phase IIIB - Oakland
3. Berthing Areas - Oakland
4. Phase IIIA - Oakland (retested sediments)

R-AC = Composite sample collected from the Alcatraz disposal site
R-AM = Composite sample collected offsite in the Alcatraz environs
U = Undetected above concentration shown
B = Analyte found in blank
J = Analyte detected below method detection limit
E = Value is estimated; not confirmed on second column
NA = Not Available

Relative to bay-wide concentrations (see Table 3.3.1-2), the Alcatraz disposal site and environs sediments have lower concentrations of most metals, PCBs, and DDTs. The exception to this trend is chromium; chromium concentrations in Alcatraz sediments exceed the mean concentration of chromium for in-Bay peripheral (i.e., harbor and channel) areas up to five times. As shown in Table 3.3.3.2-1, concentrations of PAH compounds have been highly variable on and off the Alcatraz disposal site during successive studies, ranging from 139 to 36,830 ppb. The mean concentrations of total PAH in basins and peripheral areas from Long et al. (1988) are 2700 ppb and 2480 ppb, respectively. Regional in-Bay concentrations exceeded total PAH concentrations measured in four of the seven sets of data provided for Alcatraz sediments (see Table 3.3.3.2-1). Sediments collected adjacent to the disposal site were also used as reference samples for toxicity and bioaccumulation testing of the proposed dredged sediments. This is a very conservative representation of the condition of the Central Bay because the high sands and gravels (97 percent) at the site indicate that it is not a depositional site. Thus, this site is less affected by deposition of waterborne contaminants than the depositional areas in the Central Bay. The mean percent survival was typically greater than 80 percent for R-AC samples and greater than 90 percent for R-AM samples with few exceptions. Metals, PAHs, tributyltins, DDTs, and PCBs (especially Aroclor 1254) were measured in on-site (i.e., R-AC) and off-site (i.e., R-AM) samples. Reference samples collected on site, however, typically demonstrated more detected compounds than did the off-site reference samples. For all phases of the testing program, Oakland Harbor toxicity testing results typically demonstrated a significant response from those collected in the Alcatraz Island environs. In comparison to treatments collected from within the disposal site, there were fewer samples showing significantly different responses or bioaccumulation. The exception to this is the relatively "clean," sandy sediments collected from on site associated with the Oakland Phase IIIB project (Battelle 1992a). These data suggest sediments on site at Alcatraz are potentially more contaminated than surrounding sediments; however, with the exception of chromium and PAHs, few analytes measured in on-site sediments exceed Bay-wide average concentrations.

3.3.3.3 Bay Farm Borrow Area

Based upon results of sediment profile photography surveys performed in 1990 and 1991, the Bay Farm Borrow Area (BFBA) can be partitioned into four areas of distinct sediment types (see Figure 3.3.3.3-1) (OBAI 1990,1991; SAIC 1992a), as follows:

- A relatively deep (>20 ft) excavated pit area composed of very fine grained sediment (83 percent fines) having a high water content.
- A deep (10-20 ft) ambient mud bottom located west of the excavated portion of the pit characterized by slightly sandy silts (82 percent fines) and a relatively stable surface and subsurface infaunal community.
- A shallow, shell-rich area located north and east of the pit, comprised of a veneer of oyster shells, mussel shells, and benthic macroalgae overlying varied sandy silts (52 percent fines), with predominantly surface dwelling benthic infauna and abundant epizoans.
- A region of well-sorted sands (96 percent sand) having fragments of shell debris interspersed throughout the sediment column located south of the excavated portion of



Figure 3.3.3.3-1

THE SAMPLING GRID AND STATIONS SAMPLED DURING SURVEYS OF THE BAY FARM BORROW AREA

Table 3.3.3.3-1. Mean Detected Conventional and Contaminants Data for Bay Farm Borrow Area Sediments Collected in Reconnaissance and Seasonal Surveys

<i>Parameter</i>	<i>E8</i>	<i>A6</i>	<i>E4</i>	<i>G10</i>
CONVENTIONALS				
TOC (%)	1.2	2.5	2.9	0.45
Total Solids (%)	37	54	45	79
Gravel (%)	0.33	19.5	3.5	1.5
Sand (%)	5	29	15	96
Silt (%)	43	24	43	1.5
Clay (%)	40	28	39	0.67
Oil and Grease (ppm, dry)	35	49	62	30
TPH (ppm, dry)	38	45	48	18
METALS (ppm, dry weight)				
Arsenic	12	7.3	11	4.3
Cadmium	0.20	0.33	0.34	0.05
Chromium	174	94	167	40
Copper	52	28	51	6.5
Lead	27	15	34	17
Mercury	0.694	0.247	0.476	0.053
Nickel	107	57	101	14
Selenium	0.64	0.18	0.63	0.22
Silver	0.36	0.24	0.41	0.05
Zinc	148	85	145	22
ORGANICS (ppb, dry weight)				
Butyltins				
Tributyltin	2.9	2.7	1.9	0.9
Dibutyltin	2.3	1.7	2.3	2.9
Monobutyltin	3.4	ND	3.7	ND
Chlorinated Pesticides				
Aldrin	2.1	ND	0.9	1.4
Dieldrin	2.0	2.3	ND	1.2
Endosulfan II	ND	ND	1.2	ND
Lindane	2.8	1.1	1.9	0.83
Total DDT	2.9	3.9	3.2	ND
Total PCBs	30	42	58	ND
Phenols				
Phenol	ND	188	224	ND
4-Methylphenol	140	260	65	ND
LPAHs				
Total	89	74	170	1.08
HPAHs				
Total	1206	368	1905	6.9
Bis(2-ethylhexyl)phthalate	96	ND	61	ND

Notes: ND = Not Detected

Sources: OBAI 1990, 1991; SAIC 1992a-d, 1993a.

the borrow pit, exhibiting a sparse epifaunal, surface deposit feeding and detritivorous benthic community.

The physical nature of these areas of distinct sediment type provide information of depositional history, the distribution of fine grained material, and hence the likely distribution of certain target analytes. Table 3.3.3.3-1 summarizes the conventional and contaminants data from surveys performed at the Borrow Area since 1990. The same stations were occupied in successive years. These stations are identified in Figure 3.3.3.3-1. The mean chemical concentrations provided in Table 3.3.3.3-1 represent "same station" averages of data collected in time series. Total oil and grease, total petroleum hydrocarbons, metals, chlorinated pesticides, phenol, 4-methylphenol, and PAHs were detected in BFBA sediments. Elevated levels of metals, PAHs, and butyltins were present within the pit and to the west of the pit. Pesticides and PCBS were also measured at elevated levels in the pit, and in muds west and north of the pit. The area sampled south of the pit was, in general, the least contaminated.

To place the BFBA sediments into perspective regionally, concentrations of most metals and organics at the BFBA are comparable to or lower than mean metals concentrations measured in several in-Bay studies reported by Long et al. (1988) (see Table 3.3.1-2). Sediment chemistry concentrations at the BFBA are generally similar to average concentrations measured in the basins of the Bay. The peripheral areas of the Bay (i.e., in harbors and channels) have maximum mean concentrations of cadmium, copper, lead, silver, total DDTs and total PCBs in comparison to either average basin sediments or BFBA sediments. Maximum mean concentrations of chromium and mercury, however, were measured in the fine-grained sediments collected from within the borrow pit of the BFBA. Total PAH concentrations are somewhat similar between the BFBA, basins, and peripheral areas, although total PAH concentrations in BFBA sediments tend to be lower than Bay-wide concentrations.

In addition to chemical analysis, the composited BFBA sediments collected by Battelle (1992a-c) were used as reference sediments in bioassay and bioaccumulation testing of Oakland Harbor test sediments. The results of the BFBA sediments provide information on the biological toxicity of the area sediments. For acute toxicity tests, high survivorship was noted among the Bay Farm reference treatments. Bioaccumulation results using *Macoma nasuta* and *Nephtys caicoides* showed concentrations of metals, PAHs (especially fluoranthene, pyrene, chrysene, fluorene, naphthalene, and phenanthrene), dibutyltin, dieldrin, DDTs (especially DDE), and the PCB Aroclor 1254 among BFBA sediments. Overall, relatively few statistically significant differences were noted between Oakland Harbor toxicity and bioaccumulation data and BFBA reference sediments. This is a reflection of the moderate PAH and metals concentrations observed in the fine-grained borrow pit sediments.

These data indicate that fine-grained sediments within the borrow pit and ambient mud to the west of the pit show evidence of anthropogenic inputs. For metals and PAH compounds, the BFBA sediments exhibit toxicity and bioaccumulation responses within the range of the Oakland Harbor sediment responses (Battelle 1992a-c). The metals, mercury and chromium, are detected at relatively high levels within the fine-grained BFBA sediments in comparison to Bay-wide mercury and chromium concentrations; however, they do not generally exhibit concentrations exceeding bay-wide average concentrations (SAIC 1993a).

3.3.3.4 Leonard Ranch/Redwood Landfill

Leonard Ranch Rehandling Option

The proposed sediment rehandling site is located in recent alluvium and bay muds along the floodplain of the Petaluma River (Figure 3.2.4.4-1). These sediments have been diked, drained, and cultivated for agricultural uses, primarily for the production of oat hay. The site is located in an area underlain by unconsolidated Quaternary alluvium, bay mud deposits, and alluvial fan deposits and overlying soil, which is part of the Reyes Series (figures 3.2.4.4-2 and 3.2.4.4-3). Unconsolidated deposits range from 0 to over 500 feet thick (CDWR 1975). Bedrock in the vicinity of the site includes (1) volcanic rocks and sediments of the Tertiary Sonoma Volcanics and Tolay Volcanics, (2) sandstone of the Tertiary Merced Formation, (3) consolidated clay and shale of the Tertiary Petaluma Formation, and (4) the Franciscan Complex consisting of sandstone, mudstone, and greenstone. The site is approximately 4.5 miles west of the Rodgers Creek Fault and 16 miles east of the San Andreas Fault. There are no known active (i.e., Holocene) or potentially active (i.e., Quaternary) faults within 0.5 mile of the site, nor is the site within an Alquist-Priolo Special Studies Zone.

The Reyes Series soil consists of poorly drained silty clays that have formed in mixed bay and stream alluvium. The A horizon of this soil is typically light brown gray to grayish brown; while the B horizon varies considerably depending upon the percentage of fine material and humus present. Due to this draining and cultivation, the top 2 to 4 feet of the soil tends to be desiccated and stiffer than the underlying mud. The Reyes Series soil generally has a slow permeability and may contribute to surficial ponding. Undisturbed Reyes Series soil have generally neutral pH but after cultivation become more acidic due to the oxidation of sulfides under the altered drainage conditions (USDA 1985). The soil is underlain by clay and silt of mixed river and bay sediments with an undulating upper boundary at depths that range from 2 to 8 feet below the ground surface.

3.3.3.5 Sonoma Baylands

The proposed wetlands restoration site is located immediately south of the proposed Leonard Ranch Rehandling site in recent alluvium and bay muds along the floodplain of the Petaluma River (Figure 3.2.4.4-1). The baseline description of geology, soils, and seismicity at the Leonard Ranch site (see section 3.3.3.4) also applies to the Sonoma Baylands site.

3.3.3.6 Galbraith Golf Course

The Galbraith Golf Course site consists of a golf course that was constructed over a landfill which was closed in 1965. The site is located in an area underlain by unconsolidated sediments, primarily tidal marshland deposits and stream-laid alluvium, and overlying artificial fill material from the filling of tidal flatlands (ACFCWCD 1988; BEC 1991; Wahler Associates 1987; HLA 1993 unpublished data). Bedrock, mostly sandstone, shale, and chert of Mesozoic age, lies east of the Hayward fault (3 to 4 miles east of the site) and beneath the unconsolidated deposits (figures 3.2.4.6-1 and 3.2.4.6-2) (ACFCWCD 1988).

Unconsolidated deposits, which reach thicknesses of up to 1,100 feet, were deposited in the valley formed as a result of movement along the Hayward fault in the Pliocene and Pleistocene age. Most of the deposits are derived from the Diablo Range to the east. Unconsolidated deposits, which consist of gravel,

sand, silt, and clay layers, have been differentiated into six geologic units: younger alluvium, fluvial deposits, interfluvial basin deposits, bay mud, Merritt Sand, and older alluvium (ACFCWCD 1988).

Boring locations from environmental investigations (BEC 1991; HLA 1993 unpublished data) were conducted at the site. A description of lithologic units encountered at the site is summarized below.

Artificial fill materials identified at the site from the filling of tidal flatlands include:

- Fill/vegetative cover - generally a thin surficial layer (i.e., approximately 1 foot thick) free of manmade debris and composed of silty clay to silty sand with gravel (absent in a few areas and up to 10.5 feet thick in others)
- Debris fill - debris consisting of construction debris, wood, brick, concrete, scrap metal, etc. and household refuse (glass, paper, etc.) in a loose sandy clay to clayey sand with gravel matrix (throughout the site, from 0 to over 20 feet in thickness)
- Hydraulic fill - dredged sands and bay mud from offshore locations (central and western portions of site, up to 10 to 15 feet thick).

A layer of bay mud deposits (fat clay and silty clay; approximately 2 to 10 feet thick) and underlying alluvium (stiff clays and medium dense to dense sand) are beneath the fill material and throughout most of the site (Wahler Associates 1987; BEC 1991; Subsurface Consultants 1991; HLA 1993 unpublished data).

The site is located in the vicinity of two active faults; the Hayward fault mentioned above and the San Andreas fault lie approximately 4 miles east and 14 miles west of the site, respectively. A large magnitude earthquake on either of these faults would produce strong ground shaking at this site. The potential for settlement and liquefaction may be considered moderate.

3.3.3.7 Port/Landfill

There are no geologic resources associated with the Port/Landfill disposal option. The site is a paved terminal yard, supported on piles in the Oakland Inner Harbor. Geology, soils, and seismicity for the Oakland Harbor are discussed under section 3.3.2.

3.3.3.8 Montezuma Wetlands

The Montezuma Wetlands Site is located in recent alluvium and bay muds in the floodplain of the Sacramento River and the Montezuma Hills. It contains river basin and marsh deposits (75 to 90 feet deep) consisting of unconsolidated peat, clays, and silt with discontinuous sand and gravel lenses. The western portion of the site contains peat beds up to 30 feet thick, while the southern margin of the site contains greater amounts of sand than other parts of the site. These sediments have been diked and drained since the 1880s. The major soils associations found at the site are Joice muck, Tamba mucky clay, and Reyes silty clay near the levee along Montezuma Slough. These poorly drained soils are located in nearly level areas, presenting little potential for erosion. These soils are underlain by Quaternary coarse-grained sand and gravel deposits (USDA 1977; Levine-Fricke 1992).

1 The Reyes series soil are described above in section 3.3.3.4.
2

3 The Joice Series consists of very poorly drained muck that has formed in mixed bay and stream alluvium.
4 The soil typically is black, clayey muck to a depth of more than 5 feet. The Joice Series soil generally
5 has a moderately rapid permeability but may contribute to surficial ponding.
6

7 The Tamba Series consists of very poorly drained, mucky clay that has formed in mixed bay and stream
8 alluvium. Tamba Series soil is light brownish-gray, grayish-brown, and yellowish-brown, mottled mucky
9 clay about 10 inches thick, underlain by mottled, mucky clay that extends to depths of more than 5 feet.
10 The Tamba Series soil generally has a moderate permeability but may contribute to surficial ponding.
11

12 The site is approximately 4.5 miles northwest of the Antioch Fault zone and approximately 12.5 miles
13 southeast of the Green Valley Fault. There are no known active (i.e., Holocene) faults within 0.5 mile
14 of the site, nor is the site within an Alquist-Priolo Special Studies Zone. The Montezuma Fault is
15 postulated to exist west of the site based on trends in seismicity. Although it has not been identified on
16 land, it has not been included in an Alquist-Priolo Special Studies zone, nor has it been documented as
17 an active fault (Levine-Fricke 1992). The postulated location for the Montezuma Fault is a line between
18 PG&E's Pittsburg Power Plant and the east side of Kirby Hills to the north. As such, the Montezuma
19 Fault does not cross the site but appears to the west of the site (Levine-Fricke 1992).

3.4 BIOLOGICAL RESOURCES

3.4.1 Regional

3.4.1.1 Marine Resources

Plankton Community

Studies of phytoplankton and zooplankton populations in San Francisco Bay and adjacent coastal areas exhibit species composition, abundance, and biomass changes that reflect seasonal variations in physical and chemical parameters such as light, temperature, salinity, available nutrients, upwelling, current regimes, and hydraulic conditions within the estuary (EPA 1993a; Cloern 1979). Phytoplankton classes present include diatoms (Bacillariophyceae), coccolithophores (Haptophyta), dinoflagellates (Pyrrophyta), silicoflagellates (Chrysophyta), cryptomonads (Cryptophyceae), and green algae (Chlorophyceae).

Phytoplankton populations off the central California coast are influenced by seasonal upwelling and nutrient inputs from San Francisco Bay, resulting in high productivity particularly over the continental shelf (EPA 1993a). Periods of upwelling generally occur between March and August, at which time the community is dominated by the diatoms *Chaetoceros* spp. and *Rhizolenia* spp. Dinoflagellates such as *Ceratium* and *Peridinium* predominate during non-upwelling periods.

Prevalent species composing phytoplankton blooms particularly in Central San Francisco Bay and San Pablo Bay are coastal species that have been dispersed into the bay (Cloern 1979). Large populations of *Skeletonema costatum*, another neritic diatom, has been observed near the shallow tidal flats of the north end of the bay, in the vicinity of the Sacramento-San Joaquin river channel. Predominant phytoplankton within the South Bay are also diatoms, although in some years the phytoplankton blooms in the South Bay are composed primarily of microflagellates (dinoflagellates, cryptomonads, and coccolithophores). These differences in the South Bay generally reflect variations in river outflow and stratification of the water column (Cloern 1979, see section 3.4.2.3).

Zooplankton abundances reflect changes in abundance in phytoplankton. The predominant zooplankton off California include various copepods (e.g., *Acartia* spp. and *Calanus* spp.), euphausiids (*Euphausia pacifica*), juvenile fish and invertebrate species, salps, chaetognaths (arrow worms), and pelagic mollusks. Salps and pelagic molluscs were generally found offshore, while the other zooplankton types were found nearshore and offshore. Among the juveniles were early life stages (zoeae) of crabs, such as rock and Dungeness crabs. Juveniles of fish and crustaceans tended to be more prevalent in the nearshore areas (EPA 1993a).

Copepods are among the most abundant zooplankton found within San Francisco Bay. Typical species found within the estuary are *Acartia clausi*, *Acartia californiensis*, and *Eurytemora affinis*. Other zooplankton found within the Bay include various fish larvae (e.g., gobies, anchovies); early development stages of crabs (*Cancer* spp.), shrimp (*Crangon* spp.), gastropods, barnacles, and polychaetes; and fish eggs (COE 1979).

Benthic Community

OCEAN

Recent studies characterizing infaunal and demersal epifaunal slope communities off San Francisco show that community development is clearly zoned by depth (SAIC 1992f). Wakefield (1990) recognized factors influencing megafaunal community structure to include differences in the sedimentary environment, the oxygen minimum zone (OMZ), and regional current patterns. In general, sediments change from coarse-grained sands in the shelf and upper continental slope habitats to fine-grained muds on the middle to lower slope at about 1,800 m. The upper slope is influenced by the OMZ, especially between 600 and 1,000 m depth.

Benthic communities and epifaunal community descriptions are based primarily on recent EPA and U.S. Navy surveys of the LTMS study region (SAIC 1992e,f).

Demersal Megafauna. Communities near shore on the continental shelf (from depths of 72 m to approximately 200 m) are typically dominated by echinoderms (brittle and sea stars), cnidarians (sea pens), and molluscs (octopus). The highest density taxa included brittle stars and the sand star *Luidia foliolata*. The Dungeness crab (*Cancer magister*) and squid are in low abundance and are the only invertebrate species of commercial value.

Upper and middle slope megafaunal communities (between 200 m to 500 m and 500 m to 1,200 m respectively) are characterized by moderate to high numbers of species. Density and biomass are relatively high due to such species as the Tanner crab (*Chionoecetes tanneri*) seastars, brittle stars, snails, and sea cucumbers.

The lower slope communities are characterized by relatively high numbers of species within the sea cucumbers, brittlestars, seastars, and sea pens. Density and biomass are high at these depths due mainly to high numbers of sea cucumbers, brittle stars, and seastars.

The deeper regions of the continental rise (depths from 2,000 m to almost 4,000 m) are characterized by low numbers of taxa, densities, and biomass. The species composition is similar to the lower slope communities, including sea cucumbers, brittlestars, seastars, and sea pens (Nybakken et al. 1992).

Epifauna. In the shallower depth of the continental shelf, polychaete worms represent 48 percent of the total species and 76 percent of individuals. The two genera *Prionospio* and *Spiophanes* account for 50 percent of the individuals. Amphipod crustaceans and gastropod snails are the next dominant taxa. Other major infaunal taxa found only in the shallower slope areas include decapods, mysids, ostracods, and phoronids.

Infaunal densities are highest in the continental shelf communities. Generally there is a trend toward decreasing species diversity and species richness with increasing depth across the continental slope (SAIC 1992f). The most abundant crustacean is the filter feeding amphipod *Photis*. Common subsurface deposit feeding polychaetes include *Cossura pygodactylata*, *Cossura rostrata*, and *Aricidea ramosa*, and *Aricidea simplex*. Common crustaceans include the tanaidacean *Pseudotanaids* spp. and isopods.

In areas of the lower continental slope/continental rise, species diversity and density decrease (EPA 1993a; SAIC 1992f). Polychaetes comprise 48 percent, crustaceans 32 percent, and molluscs 8 percent of species (SAIC 1992f). When stations are grouped along isobaths, different taxa become characteristic. The 2,400 m contour is dominated by the polychaete *Aricidea simplex*; the 2,700 m contour is dominated by the polychaetes *Prionospio delta*, *Chaetozone* spp. and *Aricidea simplex*; while the 3,000 m contour includes the polychaetes *Prionospio delta*, *Levinsonia* nr. *flava*, and the aplacophoran *Spathoderma* spp.

SAN FRANCISCO BAY

The primary benthic habitats found throughout San Francisco Bay consist of the following:

1. A brackish-water embayment (Suisun Bay) influenced by the tides and river outflow, resulting in high salinity variability and scoured channels.
2. Broad intertidal (north San Pablo Bay) mudflats and shallow subtidal regions of San Pablo Bay, which are affected by reduced salinities and heavy siltation during high winter river runoff.
3. A highly dynamic marine region (due to strong tidal currents) comprised of sandy sediments and rocky outcrops (Central San Francisco Bay).
4. Subtidal mud areas and regions covered with shell deposits (South Bay) (Nichols and Pamatmat 1988).

The study area for this project includes the Central Bay and the South Bay. The small clam *Macoma balthica* is the predominant species in the Central Bay, particularly in the intertidal areas. Common species found in Central Bay subtidal habitats include the mollusks *Mya arenaria*, *Gemma gemma*, *Musculista senhousia*, and *Venerupis philippinarum*; the amphipods *Ampelisca abdita*, *Grandierella japonica*, and *Corophium* sp.; and the polychaetes *Streblospio benedicti*, *Glycinde* sp. and *Polydora* sp. Hard-substrate species such as the mussel *Mytilus edulis* occur on rocky outcrops (Nichols and Pamatmat 1988). *Gemma gemma*, *Musculista senhousia*, *Venerupis philippinarum*, the gastropod *Crepidula convexa*, the polychaete *Exogone lourei*, and the tunicate *Mogula manhattensis* are typical species found among the South Bay shell deposits (SAIC 1993a; Nichols and Pamatmat 1988). Species expected to be present in the mudflat regions include those common to the Central Bay, and such species as the polychaete *Euchone limnicola* and the bivalve *Theora lubrica*.

Fish Community

Coastal shelf, slope, or pelagic species that occur off central California include a variety of demersal and pelagic species including various flatfish, rockfish, surfperch, anchovies, smelt, herring, sablefish, eelpouts, and thornyheads. Surveys conducted in 1991 off central California along the shelf and slope, indicated several communities based on depth and depth-related factors (EPA 1993a). These include a shelf community (72 to 200 m) dominated by sanddabs, English sole (*Pleuronectes vetulus*), rex sole (*Errex zachirus*), rockfishes, pink surfperch (*Zalemibus rosaceus*), plainfin midshipman (*Porichthys notatus*) and white croakers (*Genyonemus lineatus*). Upper (200 to 500 m) and middle (500 to 1200 m) slope communities are comprised of rockfish, thornyheads, various flatfish, sablefish, eelpouts, hake (*Merluccius productus*), slickheads, and rattails (middle slope). Fish of lower slope communities (1,200

Setting – Biological Resources

m to > 3,200 m) include rattails, thornyheads, and eelpouts (EPA 1993a). The Dover sole (*Microstomus pacificus*, a deepsea flatfish) and sablefish are of commercial importance (U.S. Navy 1993a).

A wide variety of fish inhabit San Francisco Bay including estuarine, marine, and anadromous fishes. Among them are various flatfish, surfperch, gobies, sculpin, bait and forage fish (anchovies, herring, smelt), pipefish, croakers, silversides, sharks, and rays. Flatfish common to areas in San Francisco Bay comprised of sandy-silt sediments include the English sole, starry flounder (*Platichthys stellatus*), California halibut (*Paralichthys californicus*), and diamond turbot (*Hypsopsetta guttulata*) (COE 1992a). Other common bottom fish include Bay gobies (*Lepidogobius lepidus*) and the Pacific staghorn sculpin (*Leptocottus armatus*). White croakers usually occur in shallow water and feed on various benthic invertebrates (Hart 1973). This species is often very abundant in the South Bay and San Pablo Bay (Smith and Kato 1979). The croakers spawn nearshore particularly in the late fall and winter (U.S. Navy 1993a).

Northern anchovies (*Engraulis mordax*), a pelagic marine species, occur in the Bay year-round. Anchovies serve as an important food source for a variety fish and bird species such as salmon, jacksmelt, striped bass, pelicans, terns, and grebes. Pacific herring (*Clupea pallasii*) is also another important forage food. Herring enter the estuary in the winter and early spring in order to spawn, particularly in rocky areas, along seaweed or eelgrass covered substrates, on pilings, and sandy beaches (U.S. Navy 1993a). Some of the herring spawning areas include the shoreline between the Bay Bridge and San Leandro Yacht Harbor, along the Alameda and Oakland waterfront, Sausalito and Tiburon Peninsula, and other shoreline areas of Central and San Pablo Bays (U.S. Navy 1993a; Smith and Kato 1979). Surfperch often occur nearshore, feeding on small crustaceans (amphipods, cumaceans), mollusks, and polychaete worms. Among the surfperch species are shiner (*Cymatogaster aggregata*) and pile surfperch (*Rhacochilus vacca*), which are also commonly found in the various harbors around the bay (Smith and Kato 1979; COE 1984).

Sharks and rays tend to be more abundant in the South Bay and appear to prefer shallow waters. The most abundant shark occurring in the bay is the brown smoothhound (*Mustelus henlei*), although leopard and dogfish sharks (*Triakis semifasciata* and *Squalus acanthias*) are also quite common. Bat rays and sharks are often found along the mudflats feeding on molluscs (Nichols and Pamatmat 1988).

Anadromous fishes that pass through the bay to spawn upstream, particularly in the Sacramento-San Joaquin river system, include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), and chinook salmon (*Oncorhynchus tshawytscha*). Striped bass and American shad, both introduced species, migrate in winter and spring, and from April to June, respectively (U.S. Navy 1993a; Smith and Kato 1979). Chinook salmon migrate mainly in the fall, although the winter-run chinook salmon (a state endangered and federally threatened species) migrate from November to May (U.S. Navy 1993a; COE 1992a). Additional anadromous fish found within the estuary include white and green sturgeon (*Acipenser transmontanus* and *Acipenser medirostris*), which generally move upstream in the spring (Smith and Kato 1979).

Marine Birds and Mammals

Marine mammals and birds occurring in San Francisco Bay and off the central California coast include both migratory and year-round residents.

Marine birds surveys, conducted by the Point Reyes Bird Observatory (PRBO) from 1985 to 1991, indicated a wide variety of pelagic, shelf, and nearshore species off central California (EPA 1993a; U.S. Navy 1993a). Pelagic species include various storm-petrels, petrels, and albatross (EPA 1993a; U.S. Navy 1993a). Common shelf species include cormorants, pelicans, guillemots, loons, and terns. Brandt's (*Phalacrocorax penicillatus*) and Pelagic cormorants (*Phalacrocorax pelagicus*), Cassin's auklets (*Ptychoramphus aleuticus*), common murrelets (*Uria aalge*), western gulls (*Larus occidentalis*), and Forster's terns (*Sterna forsteri*) exhibited high abundances and are present year-round. Species that are present in the summer include sooty shearwaters (*Puffinus griseus*), double-crested cormorants (*Phalacrocorax auritus*), and Murphy's petrel (*Pterodroma ultima*). The loons, phalaropes, surf scoters (*Melanitta perspicillata*), Sabine's (*Xema sabini*) and herring gulls (*Larus argentatus*), and jaegers were among the wintering species. Many of the marine bird species feed, roost, or breed on the Farallon Islands, and forage in the surrounding waters.

Species within the estuary in central San Francisco Bay area are those that are also found along the nearshore shelf regions. These species include a variety of cormorants, gulls, scoters, murrelets, guillemots, and grebes. Similar species are also found throughout the Bay, although diving ducks such as scaups (*Aythya* spp.) would likely be present in the less dynamic areas of the estuary including San Pablo Bay, South Bay, and the harbors. Wintering species occurring in the area include the common loon (*Gavia immer*), surf scoter, and western grebe (*Aechmophorus occidentalis*). The least tern (*Sterna antillarum*) is a spring and summer migrant that breeds at specific locations within the estuary (see Threatened, Endangered, and Sensitive Species below). Shorebirds, such as sanderlings (*Calidris alba*), are also present within the estuary.

Marine mammals found offshore include a variety of cetacean, pinniped, and fissiped species. Species commonly observed during the PRBO surveys include the harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), Risso's dolphin (*Grampus griseus*), and the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) (EPA 1993a; U.S. Navy 1993a). These species are found year-round along the shelf or slope. Humpback, minke, and gray whales (*Megaptera novaeangliae*, *Balaenoptera acutorostrata*, and *Eschrichtius robustus*) were the most abundant whale species observed. Seasonal visitors that feed in the region, particularly in the Gulf of the Farallones, include gray, humpback, and blue whales (*Balaenoptera musculus*) (EPA 1993a). Species that migrate through the area, but apparently do not feed in the area, include finback (*Balaenoptera physalus*), sperm (*Physeter macrocephalus*), sei (*Balaenoptera borealis*), and right (*Eubalaena glacialis*) whales (EPA 1993a). With the exception of the gray and minke whales, these whale species are on the federal list for endangered species. Common pinniped species that are pelagic or occur over the slope areas include the northern elephant seal (*Mirounga angustirostris*) and northern fur seal (*Callorhinus ursinus*) (EPA 1993a; U.S. Navy 1993a). Steller sea lions (*Eumetopias jubatus*) occur over shelf areas, although they are fairly uncommon.

Marine mammals that are abundant offshore in the shallower shelf waters also occur in the San Francisco Bay estuary. These include the California sea lion (*Zalophus californianus*), harbor seals (*Phoca vitulina*), and harbor porpoises. Harbor porpoises are usually found in the Central Bay area, particularly near the entrance to the estuary at the Golden Gate Bridge. The sea lions and seals are found in various regions throughout the Bay, including harbor waterways. However, seal abundances are relatively low in the harbor due to frequent disturbance and human activity.

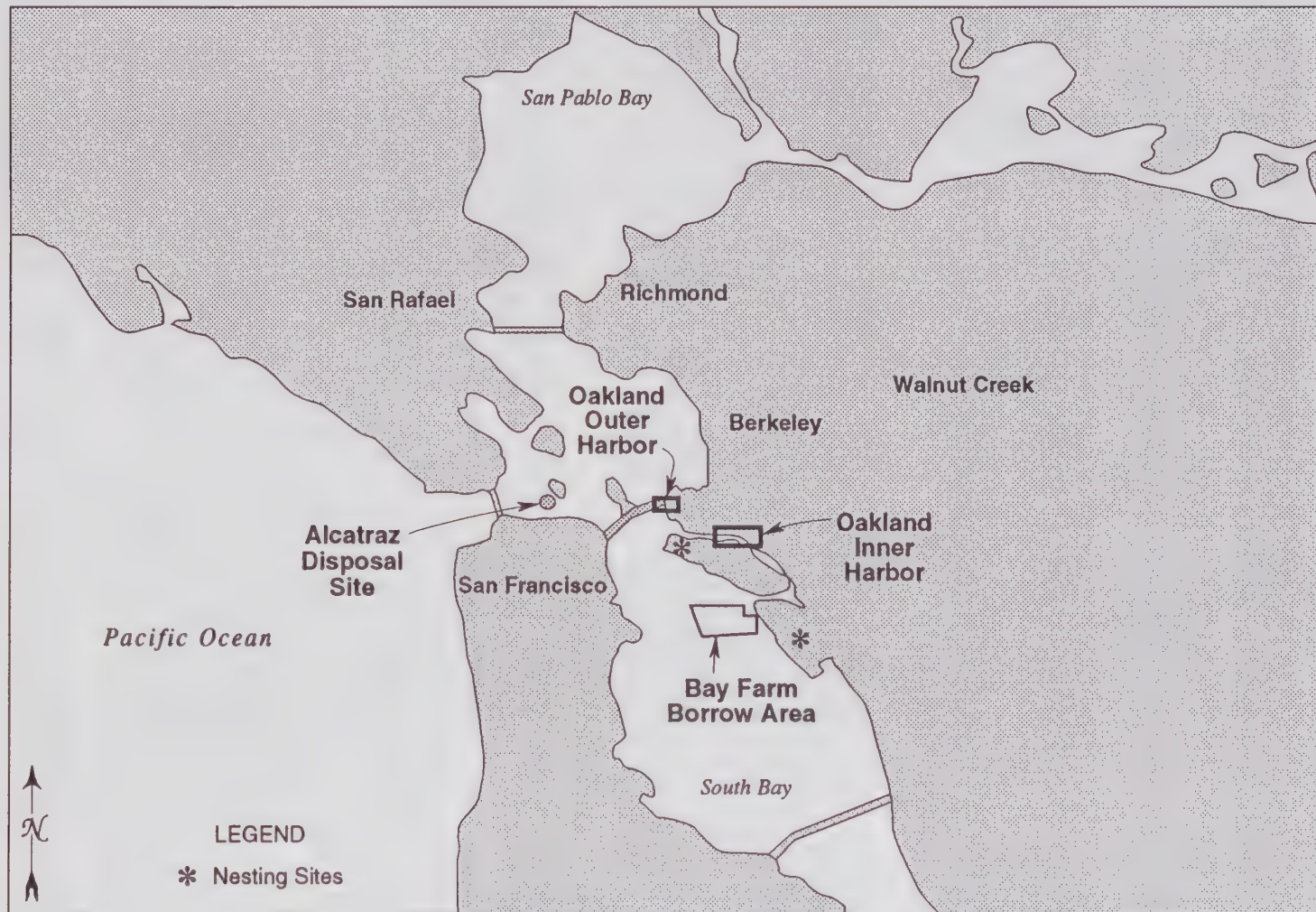


Figure 3.4.1.1-1

CALIFORNIA LEAST TERN NESTING SITES IN THE PROJECT VICINITY

Threatened, Endangered, and Sensitive Species

SAN FRANCISCO BAY

Several threatened or endangered species are known to occur or have a potential to occur either occasionally or periodically within the San Francisco Bay area. These species include the California least tern (*Sterna antillarum browni*), California brown pelican (*Pelecanus occidentalis californicus*), the American peregrine falcon (*Falco peregrinus anatum*), and the winter-run chinook salmon (*Onchorhyncus tshawytscha*).

California Least Tern (*Sterna antillarum browni*). The California least tern is listed by both the state of California and the federal government as an endangered species. The least tern is a fish-eating bird, capturing small fish by diving into the water from low flight. The majority of its diet consists of four types of fish: the northern anchovy, silversides (primarily topsmelt and jacksmelt), surfperches (primarily shiner surfperch and the walleye surfperch), and the Pacific herring (Bailey 1985). All these fish share common traits that are significant for the least tern. All are small and abundant, and are planktivorous feeders. They all school, and during certain phases in their life spans dwell near the surface. These characteristics make these fish an important trophic link between planktonic organisms and the least tern (Bailey 1986).

The least tern breeds in California from mid-May to August. Nesting colonies are located near feeding areas and need to be relatively free from disturbance. These colonies are located on open flat beaches, sand flats, and bare dirt areas with sparse vegetation (Bailey 1986). Nesting sites for least terns exist at a sandy upland site at the Oakland International Airport and along the runway apron at the Alameda Naval Air Station (COE 1992) (see Figure 3.4.1.1-1). The nesting colony of least terns has been active for at least 10 years at Naval Air Station (NAS) Alameda. This is the largest known colony north of San Luis Obispo County. The number of nests has varied from about 40 to almost 75. The least tern generally migrates from the San Francisco Bay Area in August and winters south of the United States (Peterson 1990).

California Brown Pelican (*Pelecanus occidentalis californicus*). The California brown pelican is listed by both the state of California and the federal government as an endangered species. Brown pelicans use the open waters of the central San Francisco Bay for feeding and roost on rocks, jetties, and piers in the area. The brown pelican feeds exclusively on fish, captured by diving into the water. Anchovies comprise 90 percent of the diet, with Pacific saury and rockfish comprising another 5 percent (U.S. Navy 1990).

In California, the brown pelican nests on the Northern Channel Islands offshore of southern California. Although none breed in the San Francisco area (Bay or offshore), thousands move north and roost on coastal rocks during the June through October non-breeding season. Several thousand pelicans summer in the San Francisco area (U.S. Navy 1993a). Important habitat during the non-breeding season include offshore rocks, islands, sandbars, breakwaters, and pilings. The largest brown pelican roost within the Bay is located on the breakwaters to the south of NAS Alameda, and they are known to forage along the Oakland Inner Harbor Channel (COE 1992).

American Peregrine Falcon (*Falco peregrinus anatum*). The American peregrine falcon is listed by both the state of California and the federal government as an endangered species. This species is considered

1 rare in the region, but formerly bred on the Farallon Islands (DeSante and Ainley 1980), and though it
2 has yet to breed there again, winter residents have returned and have stabilized in number (Pyle and
3 Henderson 1991).

4
5 The American peregrine falcon is most common to the San Francisco Bay area during the winter, when
6 migrants from farther north concentrate in the estuary. Their nesting season is from spring through early
7 summer, and peregrine falcons have begun nesting in the Central Bay -- several pairs nested on the San
8 Francisco-Oakland Bay Bridge (U.S. Fish and Wildlife Service [USFWS] 1992 as cited in COE 1992).
9 They are opportunistic predators and may take waterbirds and shorebirds (as well as pigeons) several
10 miles from their nests (COE 1992)

11
12 Winter-Run Chinook Salmon (*Onchorhynchus tshawytscha*). The winter-run chinook salmon is listed by
13 the state of California and the federal government as an endangered species. Winter-run chinook salmon
14 are an anadromous species that pass through the Sacramento-San Joaquin Delta, San Pablo Bay, and San
15 Francisco Bay during their upstream and downstream migrations (J. Turner, California Department of
16 Fish and Game [CDFG] as cited in EPA 1993). The winter-run chinook salmon is fished commercially
17 in North America from Kotzebue Sound, Alaska, to Santa Barbara, California (Emmett et al. 1991).
18 Juveniles of the species are ocean-dwelling and occur primarily over continental shelf waters (Fredin et
19 al. 1977). The adults are present in the Bay area from November to May, and the smolts migrate
20 through the Bay from November through May with peak abundance occurring from January through April
21 (USFWS 1992). Migrating adults have also been caught in Suisun Bay in October (COE 1992; Wang
22 1986). Estimates of chinook fry residence time in northwestern U.S. and Canadian estuaries ranged from
23 10 days to 2 months (Shepard 1981).

24
25 Chinook salmon tend to be an opportunistic feeder (Healey 1982). Fry feed mainly on zooplankton in
26 estuaries, characteristically in schools in littoral or shallow sublittoral habitats such as saltmarshes,
27 mudflats, and other intertidal areas. Adult and juvenile dipteran insects and crustacean zooplankters
28 (especially Cladocera and Copepoda) are principal food items of chinook fry in the Sacramento River and
29 the Sacramento-San Joaquin Estuary (Cannon 1982). Smolts feed on gammarid amphipods and larval fish
30 in brackish waters. Larger smolts select larger crustaceans (*Corophium* and *Neomysis*) and fish as food.
31 Food consumed by marine dwelling juveniles consists primarily of fish, crustaceans, and insects (Snyder
32 1924). Marine prey of adult chinook salmon are pelagic crustaceans such as krill, larval crabs, and fish.

33 OPEN OCEAN

34
35
36 Several threatened or endangered species occur either occasionally or periodically in the ocean offshore
37 of the San Francisco area. These species include the humpback whale (*Megaptera novaeangliae*), blue
38 whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), sperm whale (*Physeter*
39 *macrocephalus*), and the Steller sea lion (*Eumetopias jubatus*).

40
41 Humpback Whale (*Megaptera novaeangliae*). The humpback whale is listed by the federal government
42 as an endangered species. The humpback whale has a worldwide range. Distribution over the summer
43 feeding grounds ranges from the coasts of Japan and southern California north to the Chukchi Sea
44 (NOAA 1989). Humpback whales typically are found in the San Francisco area from March through
45 January with greatest concentrations occurring from mid-August through October (Dohl et al. 1983).
46 During summer months, central California populations may reach 500 animals (Dohl et al. 1983).

Summer feeding occurs from the Aleutian Islands to the Farallon Islands. Humpback whales feed on baitfish, euphausiids, pelagic crabs, and a variety of other prey in the Gulf of the Farallones in summer and early fall. Humpback whales feed at the surface down to about 150 m (Dolphin 1987).

Blue Whale (*Balaenoptera musculus*). Blue whales are listed by the federal government as an endangered species. Similar to humpback whales, the greatest abundance of blue whales within the Farallon Basin occurs in summer and early fall (Dohl et al. 1983). Blue whales are pelagic and are usually found in continental slope and deeper waters. Their primary food are euphausiids, which ensures that they occur within 200 nautical miles of the continental shelf (Dohl et al. 1978). Off northern and central California, Dohl et al. (1983) noted blue whales in waters from 80 to 3,600 m deep.

Finback Whale (*Balaenoptera physalus*). The finback whale is listed by the federal government as an endangered species. Although no finback whales were sighted in the region during recent annual surveys (Ainley and Allen 1992) and seasonal surveys (Jones and Szczepaniak 1992), Dohl et al. (1983) observed a group of finback whales just south of the Farallon Islands, and a single individual approximately 20 km west of Point Reyes, during their 1980-83 survey. They are most abundant off northern and central California during summer and autumn.

The finback whale ranges in the Pacific from the Bering Sea to Cabo San Lucas, Baja California. The finback whale feeds on small fishes, pelagic crustaceans, and squids.

Sperm Whale (*Physeter macrocephalus*). The sperm whale is listed by the federal government as an endangered species. Sperm whales regularly occur in the Gulf of the Farallones (Dohl et al. 1983). The sperm whale occurs in deep oceanic waters and is rarely reported over the shelf. The sperm whale ranges in the Pacific from the Bering Sea to the equator. They are deep divers and prey mostly upon large squid, skate, and bottom fish (Kooyman 1988).

Steller Sea Lion (*Eumetopias jubatus*). The Steller sea lion is listed by the federal government as a threatened species. The Steller sea lion ranges from California to the Bering Sea. In California, Steller sea lions have rookeries on Año Nuevo Island, S.E. Farallon Island, Sugarloaf Rock off Cape Mendocino, and S.W. Seal Rock off Point St. George. Steller sea lions breed in the late spring and summer; the onset of the breeding season (mid-May) is uniform throughout its range (Gentry 1970; Sandegren 1970; Calkins and Pitcher 1982). Steller sea lions feed primarily on squid, octopus, and fish such as smelt, flatfishes, and rockfishes (Ainley and Allen 1992).

3.4.1.2 Estuarine and Wetland Habitats

San Francisco Bay comprises the largest estuarine ecosystem in California. The system extends east to west from the Sacramento-San Joaquin River Delta to the Pacific Ocean through Suisun Bay, San Pablo Bay, and the Golden Gate. Estuarine habitats extend up the Napa and Petaluma rivers in the North Bay and to lands off the San Francisco Bay National Wildlife Refuge in the South Bay.

The estuary encompasses a range of aquatic habitats, from the fresh and brackish waters of the Delta to the saline waters of the Central and South Bay. Within the estuary, phytoplankton and zooplankton are important parts of the food chain; species dominance varies in different sections of the estuary. The waters of the estuary provide habitat for a variety of aquatic species, some of which are important to commercial and recreational fisheries. These waters serve as a nursery area for marine, anadromous,

and estuarine species, and provide a migration corridor for several anadromous species (see Table 3.4.1.2-1). Striped bass (*Morone saxatilis*), chinook salmon (*Onchorhynchus tshawytscha*), steelhead trout (*Onchorhynchus mykiss*), sturgeon (*Acipenser* spp.), American shad (*Alosa sapidissima*), and English sole (*Pleuronectes vetulus*) support important recreational fisheries in the estuary. Popular recreational fisheries in the Delta also include white catfish (*Ictalurus* sp.), largemouth bass (*Micropterus salmoides*), and sunfish (*Lepomis* sp.) (COE and Port of Oakland 1991).

Table 3.4.1.2-1. Common Fishes of San Francisco Bay

<u>Common Name</u>	<u>Scientific Name</u>
Anadromous Fish	
American shad	<i>Alosa sapidissima</i>
Chinook salmon	<i>Onchorhynchus tshawytscha</i>
Coho salmon	<i>Onchorhynchus kisutch</i>
Steelhead trout	<i>Onchorhynchus mykiss</i>
Striped bass	<i>Morone saxatilis</i>
White sturgeon	<i>Acipenser transmontanus</i>
Estuarine and Marine Fish	
Bay goby	<i>Lepidogobius lepidus</i>
Bat ray	<i>Myliobatis californica</i>
Brown smoothhound shark	<i>Mustelus henlei</i>
California tonguefish	<i>Symphurus atricauda</i>
English sole	<i>Pleuronectes vetulus</i>
Jacksmelt	<i>Atherinopsis californiensis</i>
Leopard shark	<i>Triakis semifasciata</i>
Northern anchovy	<i>Engraulis mordax</i>
Northern midshipman	<i>Porichthys</i> spp.
Pacific herring	<i>Clupea harengus pallasii</i>
Pacific tomcod	<i>Microgadus proximus</i>
Pacific staghorn sculpin	<i>Leptocottus armatus</i>
Pile perch	<i>Rhacochilus vacca</i>
Rubberlip surfperch	<i>Rhacochilus toxotes</i>
Shiner perch	<i>Cytomatogaster aggregata</i>
Speckled sanddab	<i>Citharichthys stigmaeus</i>
Spiny dogfish	<i>Squalus acanthias</i>
Starry flounder	<i>Platichthys stellatus</i>
Topsmelt	<i>Atherinops affinis</i>
White croaker	<i>Genyonemus lineatus</i>

Source: CDFG 1987; NOAA 1990.

The abundance and diversity of aquatic species in the west Delta and Suisun Bay vary with the season and year. The presence or absence of particular species and/or life stages in the Delta is dependent on the tidal cycle, time of year, and flow regime of that specific year (COE and Port of Oakland 1991). Zooplankton (such as copepods, amphipods, water fleas, and shrimps) and various phytoplankton can be found throughout the Delta. The opossum shrimp (*Neomysis mercedis*) is of particular importance because striped bass, salmonids, and other game fish feed extensively on this species (COE and Port of Oakland 1991).

The Delta is an important spawning and rearing habitat as well as a migration corridor for many species. Suisun Bay is an important nursery area for fish and invertebrate species. During most periods of Delta outflow, it is the location of the estuary's null zone. The null zone is the upstream boundary of the entrapment zone, the area in the estuary where suspended materials, including nutrients and plankton, accumulate (COE and Port of Oakland 1991). The entrapment zone typically exhibits high levels of biological productivity due to the high concentrations of nutrients found there.

Historically, marshlands bordering the Bay covered some 300 square miles (COE and Port of Oakland 1991). Currently, as a result of diking for agriculture and filling for development, these marshlands now occupy only about 75 square miles. The marshes and mudflats that remain along the margins of the Bay are very productive and provide habitat for a large number of birds and other wildlife. The Bay is a key resting, feeding, and wintering area for birds on the Pacific Flyway from Canada to Mexico. Mudflats are found in the intertidal zone and although they are devoid of vascular plants, they do support a variety of algal growth and a diversity of invertebrate fauna that provide an important food source for wintering shorebirds. Monotypic stands of cordgrass (*Spartina foliosa*) occur in the upper intertidal zone and are replaced by pickleweed (*Salicornia* spp.) at the higher elevations within this zone.

Seasonal wetlands of diked baylands that retain fresh or brackish water during the rainy season have been established in many of the diked areas around the Bay shoreline. These seasonally ponded areas often have remnant saltwater marsh vegetation such as pickleweed intermixed with more brackish and freshwater plants like saltgrass (*Distichlis spicata*), cattail (*Typha* spp.), and bulrush (*Scirpus* spp.). These seasonal wetlands are also important areas for migratory waterfowl that follow the western course of the Pacific Flyway and for resting and roosting shorebirds when high tides inundate the adjacent mudflats and marshes.

3.4.1.3 Upland Habitats

Upland habitats immediately adjacent to the Bay and its marshes are mostly urbanized. Those areas that remain in open space consist primarily of grassland and baccharis brushland vegetation. These vegetation types provide refuge habitat for wildlife using the marsh areas and support a number of foraging and seed-eating animals and birds.

3.4.1.4 Threatened, Endangered, and Sensitive Species

Determination of Status

For purposes of this analysis, sensitive species are species listed, proposed, or candidates for listing as rare, threatened, or endangered by the USFWS; species listed or proposed for listing as rare, threatened, or endangered, by the CDFG; plants occurring on lists 1A, 1B, and 2 of the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Vascular Plants of California (Smith and Berg 1988); and animals designated as "Species of Special Concern" by California Natural Diversity Data Base (CNDDB) (CDFG 1990a,b).

Wildlife and plant species listed or proposed for listing as federally threatened or endangered are protected under the Federal Endangered Species Act (ESA) (16 USC 1531 et seq.). In California, state-listed rare, threatened, or endangered wildlife and plant species are protected under the California Endangered Species Act (CESA) (California Fish and Game Code, Section 2050 et seq.).

The USFWS (letter to R. Golden, 2/1/94; Appendix C) has identified federally listed, proposed, and candidate species that may occur in the area of each of the alternative disposal sites. Sensitive species known or likely to be present at disposal sites considered in this document are discussed in the baseline sections that follow.

3.4.2 Oakland Harbor

3.4.2.1 Plankton Community

Phytoplankton and zooplankton populations within Oakland Harbor vary seasonally, having higher abundances in the spring and summer, and lower abundances in the winter (COE 1979). These generally reflect seasonal variations in physical and chemical parameters such as light, temperature, salinity, available nutrients, and hydraulic conditions within the estuary (COE 1979). Predominant classes of phytoplankton expected in Oakland Harbor include diatoms (Bacillariophyceae), cryptomonads (Cryptophyceae), and green algae (Chlorophyceae). The phytoplankton composition of Central San Francisco Bay, including Oakland Harbor, is influenced by offshore blooms in the spring. At these times, common species in the Bay are diatoms such as *Chaetoceros* spp., *Nitzschia* spp., *Rhizosolenia* spp., and *Skeletonema* spp., as well as various dinoflagellates and coccolithophores (Cloern 1979).

One of the most common types of zooplankton in the Central San Francisco Bay estuary, which are likely to be present within Oakland Harbor, are copepods (e.g., *Acartia* spp. and *Calanus* spp.). Early free swimming stages of barnacles, polychaete larvae, gastropod veliger larvae, and fish eggs are also expected to be among the plankton, as well as early stages of crabs (*Cancer* spp. zoeae) and shrimp (*Crangon* spp.) (COE 1979).

3.4.2.2 Benthic Community

The benthic infaunal community within the Oakland inner and outer harbor navigation channels generally has a low productivity in comparison to undisturbed Bay regions, due to vessel prop wash, maintenance dredging, and shoaling. Species present represent those adapted to frequent disturbance and are common to San Francisco Bay. The most common species identified in the inner harbor during surveys conducted in the 1970s included the polychaete worms *Streblospio benedicti*, *Exogone lourei*, *Cirriformia spirabbranchia*, and *Cirratulus cirratus*; the clams *Gemma gemma*, *Macoma nasuta*, *Macoma inquinata*, and *Mysella* sp.; and the mussel *Musculista senhousia* (Madrone Associates 1976 as cited in COE 1984). The most abundant species obtained during surveys of the outer harbor were the clam *Transennella tantilla*; the arthropods *Ampelisca abdita* (amphipod), *Eudorella pacifica* (cumacean), and *Leptochelia dubia*; and the polychaete *Exogone lourei* (COE 1979). Other studies performed in the mouth of the inner and outer harbors indicated similar dominant species, and additionally included the mussel *Mytilus edulis* and amphipod *Corophium* sp. among the most common species present (U.S. Navy 1990; COE 1992a). Crustaceans that may be present within the harbor include species common to San Francisco Bay such as rock or Dungeness crabs (*Cancer* sp.), shore crabs (*Hemigrapsus* sp.), and bay shrimp (*Crangon* sp.).

3.4.2.3 Fish Community

Fish common to San Francisco Bay are found within the Oakland Inner and Outer harbors, although populations are assumed to be relatively low due to frequent disturbance to the infauna from maintenance

dredging and shipping influences, and a resultant decrease in food (e.g., benthic infauna) for the fish. Typical San Francisco Bay fish expected to be within Oakland Harbor include various surfperch (shiner and pile), flatfish (flounder, sole, turbot, and halibut), sculpin, croaker, anchovy, silverside (jacksmelt and topsmelt), and goby species (Table 3.4.2.3-1). Those caught in CDFG seines in Oakland Outer Harbor included topsmelt, jacksmelt, northern anchovy, arrow goby, staghorn sculpin, and shiner perch (U.S. Navy 1990). Herring have also been observed spawning in intertidal areas of the Inner Harbor, which are not included in the dredging project, and along the Oakland-Alameda waterfront (COE 1992a; U.S. Navy 1990). The spawning season generally occurs during the months of December through February (COE 1992a). Although the harbor is generally located away from the main migration routes of anadromous fish, striped bass, American shad, and winter-run chinook salmon occasionally be present within the harbor (COE 1992a).

3.4.2.4 Marine Birds and Mammals

Marine birds use Oakland Harbor for foraging and resting, and include both year-round and migratory species. Birds found within the harbor include various shorebirds, diving ducks (scaups and canvasback), grebes, gulls, terns, pelicans, and cormorants. Common species to San Francisco Bay include Brandt's cormorant, surf scoter, western grebe, scaup, canvasback (*Aythya valisineria*), brown pelican, western and California gulls (*Larus californicus*), sanderlings, and Forester's tern. Least terns have also been observed foraging in the harbor (COE 1984).

Marine mammal species common to San Francisco Bay that occasionally are present in Oakland harbor include the California sea lion and harbor seal. Harbor seals generally avoid areas of intense activity, and thus would tend to avoid the inner harbor (U.S. Navy 1990).

3.4.2.5 Threatened, Endangered, and Sensitive Species

Threatened and endangered species that are found either occasionally or periodically within Oakland Harbor include brown pelicans, least terns, and winter-run chinook salmon. The federally threatened and state endangered chinook salmon may be found occasionally within the harbor during migrating season (November to May), although the harbor is not located within the main migration route of the species (COE 1992a). The brown pelican and least tern, both of which are state and federally listed as endangered, have been observed foraging within the Oakland Inner Harbor channel. Brown pelicans roost on the breakwaters south of the NAS Alameda, but do not breed in the San Francisco Bay area (COE 1992a). Least terns nest along the runway apron at the NAS and sandy upland sites at Oakland International Airport, which are located adjacent to Oakland Harbor and approximately 1 mile from the inner harbor (Figure 3.4.1.1-1). Although the foraging radius of the least terns, 2-3 miles, includes Oakland Harbor, the birds primarily foraged along the breakwaters and shallows of the southern shoreline of the NAS and Ballena Bay (COE 1984).

3.4.3 Disposal Site Options

3.4.3.1 Ocean Section 102

Plankton Community

Although detailed surveys of the plankton community at the ocean disposal site have not been performed,

Table 3.4.2.3-1

Common Marine Fish of San Francisco Bay Expected to Occur in Oakland Harbor

<i>Common Name</i>	<i>Scientific Name</i>	<i>General Habitat</i>
Brown smoothhound	<i>Mustelus henlei</i>	bottom
Leopard shark	<i>Triakis semifasciata</i>	bottom
Spiny dogfish shark	<i>Squalus acanthias</i>	bottom
Bat ray	<i>Myliobatus californica</i>	bottom
Northern anchovy	<i>Engraulis mordax</i>	water column
Striped bass	<i>Morone saxatilis</i>	water column
White croaker	<i>Genyonemus lineatus</i>	water column
Pacific herring	<i>Clupea harengus pallasii</i>	water column
Jacksmelt	<i>Atherinopsis californiensis</i>	water column
Topsmelt	<i>Atherinops affinis</i>	water column
American shad	<i>Alosa sapidissima</i>	water column
Shiner surfperch	<i>Cymatogaster aggregata</i>	water column
Bay goby	<i>Lepidogobius lepidus</i>	bottom
Arrow goby	<i>Clevelandia ios</i>	bottom
Plainfin midshipman	<i>Porichthys notatus</i>	bottom
Bay pipefish	<i>Syngnathus leptorhynchus</i>	bottom
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	bottom
Speckled sanddab	<i>Citharichthys stigmaeus</i>	bottom
California halibut	<i>Paralichthys californicus</i>	bottom
Starry flounder	<i>Platichthys stellatus</i>	bottom
English sole	<i>Pleuronectes vetulus</i>	bottom
California tonguefish	<i>Symphurus atricauda</i>	bottom
Diamond turbot	<i>Hypsopsetta guttulata</i>	bottom

information about plankton communities expected within the study area can be inferred from various studies performed along the central California coast and Gulf of the Farallones (Hatfield 1983; Tasto et al. 1981; and Bence et al. 1992) as reported in EPA (1993a).

Phytoplankton expected to be present within the ocean disposal area include various diatoms, coccolithophores, dinoflagellates, and silicoflagellates. Abundances and productivity are expected to be lower in the vicinity of the ocean disposal area, which is located in deep waters along the continental slope and rise, than in shallower nearshore waters. The species composition of the phytoplankton community normally varies seasonally and reflects upwelling events, current regimes, and nutrient inputs from San Francisco Bay. Diatoms that have been observed off the California coast and that tend to bloom during upwelling events include *Chaetoceros* sp. and *Rhizosolenia* sp. Dinoflagellates such as *Ceratium* sp. and *Peridinium* sp. are predominant during non-upwelling periods.

As with the phytoplankton, natural variations in zooplankton populations and distributions associated with upwelling, seasonal changes, and current patterns occur within the ocean disposal area (Ocean Section 102). Zooplankton serve as an important food source for various organisms including other zooplankton, squid, fish, seabirds, and marine mammals. Zooplankton are divided into two types: holoplankton (i.e., organisms that are planktonic throughout their life span), and meroplankton, larval stages of crabs and fish (ichthyoplankton). The former includes various copepods (e.g., *Calanus* sp., *Neocalanus* sp., *Eucalanus* sp., and *Acartia* sp.), euphausiids (e.g., *Euphausia* sp., *Nematoscelis difficilis*, and *Thysanoessa gregaria*), arrow worms (chaetognaths such as *Sagitta* sp.), and salps (Thaliaceans such as *Thalia democratica* and *Doliolum denticulatum*). Pelagic molluscs likely to be present include the gastropods *Limacina helicina*, *Clio pyramidata*, and *Corolla spectabilis*. Meroplankton within the area include fish larvae, such as rockfish larvae, which are most likely to have high abundances in winter and spring, and immature stages of crabs (*Cancer* sp. *zoeae*).

Benthic Community

Surveys were conducted in 1990 and 1991 in Study Area 5 for the EPA's LTMS program Ocean Studies Plan for dredging and disposal (EPA 1993a). This study area is located along the continental slope and rise, and incorporates the Alternative Site 5 (Ocean Section 102 site), which is located at depths of 2,800 to 3,050 m at the southwest corner of the Chemical Munitions Dumping Area. A total of 385 infaunal species were collected, comprising 48 percent polychaetes, 32 percent crustaceans, 8 percent molluscs, and 12 percent miscellaneous taxa. The taxa tended to be typical of deep-sea infaunal communities, including carnivorous or scavenging aplacophoran molluscs (shell-less, worm-shaped molluscs), tube-dwelling pogonophorans (tentaculate, worm-like, deep dwelling organisms), and detrital-feeding crustaceans such as desmosomatid isopods and tanaidaceans. Densities ranged from 4,970 to 9,870 individuals/m² in 1990, and from 750 (Station B-5, Alternative Site 5) to 7,540 individuals/m² in the 1991 survey. Species diversities were also higher in 1990 than in 1991. Study Area 5 tended to have lower infaunal densities than shallower areas surveyed. This is consistent with trends of decreasing density with depth in continental slope environments (EPA 1993a; SAIC 1992e; Blake et al. 1987).

The infaunal community composition appeared to be distributed by depth. Stations along the 2400-m depth contour were dominated by *Aricidea simplex*, a large paraonid polychaete (family Paraonidae). *Aricidea simplex* was also one of the dominant species at the 2,700 m depth, as were the polychaetes *Prionospio delta* and *Chaetozone* sp. A faunal break, as indicated by cluster analyses, between the 2,400-m and 2,700-m contours appeared to be attributed to *Prionospio delta*, a surface deposit feeding spionid

polychaete. This species was abundant in deeper waters, and less common in the shallower locations surveyed. The dominant taxa collected along the 3,000-m depth contour were the polychaetes *Prionospio delta*, *Levinsenia* nr. *flava*, and the aplacophoran *Spathoderma* sp. *Prionospio delta* was also the dominant species at Ocean Section 102.

Bottom photographs taken within Ocean Section 102 revealed a lumpy bottom near Station B-5 in the 1991 survey, suggesting a local disturbance. This station had the lowest density of benthic organisms observed throughout the survey. The disturbance might be related to a turbidity flow and implies that natural disturbances occur within Ocean Section 102.

Beam and otter trawl tows were also conducted within Study Area 5 and Alternative Site 5 in 1991, primarily between depths of 2,300 m and 3,200 m. Although densities were low (range of near zero to 270 individuals per trawl), a total of 95 megafaunal invertebrate taxa were collected, including 5 previously unknown species. Dominant taxa included sea cucumbers (*Molpadia intermedia* and *Paelopadites confundeus*), brittlestars (*Amphiura carchara*), seastars, and cnidarians (coelenterates).

Fish Community

Fish trawl surveys were conducted by the U.S. Navy within Study Area 5 in 1991 and 1992 (U.S. Navy 1993a). Fish densities were low in 1991 (e.g., 207/ha), and the dominant demersal (bottom dwelling) species were rattails, eelpouts, and morids such as finescale codling (*Antimora microlepis*). During the 1992 surveys, 15 species of fish were collected. Dominant species included rattails, eelpouts, and finescale codling. Mesopelagic and bathypelagic (midwater) fish collected during the surveys included lanternfishes, deep-sea smelts, hatchetfishes, and viperfishes. Among the commercially valuable fish collected within Study Area 5 were juveniles of shortbelly and yellowtail rockfish (*Sebastes jordani* and *Sebastes flavidus*, respectively), bocaccio (*Sebastes paucispinis*), rex sole, and Pacific hake. Adult Pacific hake and Pacific herring were also collected within the study area.

Marine Birds and Mammals

Several surveys of bird populations were conducted by various groups off the California coast and in the general vicinity of the proposed ocean disposal site. These include surveys reported in Ainley and Allen (1992) and conducted by the Point Reyes Bird Observatory (PRBO) during April and June, 1985-1991, in general vicinity of the study site, and during July 1991 in the immediate vicinity of the study site. Other surveys occurred during an LTMS program study conducted seasonally between August 1990 and October 1991 (Jones and Szczepaniak 1992).

Bird species that were observed within the study site and its general vicinity are presented in tables 3.4.3.1-1 and 3.4.3.1-2 (EPA 1993a, U.S. Navy 1993a). Table 3.4.3.1-1 indicates slope and pelagic marine bird species observed off the California coast and in the general vicinity of the study area, and Table 3.4.3.1-2 indicates the relative densities of the most common species observed within the study site. The species listed include both migratory species and those that are present year round. The prevalence of particular species reflects the species' individual migratory, feeding, and breeding behaviors. Because the study site is located near the Farallon Islands, many species that use the islands as a breeding site may be found foraging near or within the study site. Common species within the study site during the summer included sooty shearwaters, Cassin's auklets, and red-necked phalaropes. The common murre, which breeds in the Farallones, exhibited moderate to high densities within the study area during the spring, but

moved to shallower waters closer to shore in the summer (U.S. Navy 1993a). Species such as the red-necked phalarope and Sabine's gulls were observed in the area during migration and as a result tended to be abundant for a relatively short period of time in the area. Because the study site is located in deeper waters along the continental slope, slope and pelagic species such as the ashy storm petrel and rhinoceros auklet are common within the study area (U.S. Navy 1993a).

Marine mammal surveys were conducted by the PRBO concurrent with the bird surveys. Up to 27 species of marine mammals including cetaceans (whales, dolphins, and porpoises), pinnipeds (seals and sea lions), and fissipeds (otters) were observed off the central California coast in the general vicinity of the study area (U.S. Navy 1993a). These included both migrant and resident species. Table 3.4.3.1-2 lists the relative densities of the most common species noted within the study area. The most common cetaceans observed within the site were the Pacific white-sided dolphin and Dall's porpoise (Dohl et al. 1983; EPA 1993a; U.S. Navy 1993a). A gray whale and Risso's dolphin were also sighted within the vicinity of the study area (PRBO 1991 as cited in U.S. Navy 1993a). Migrating species found off the California coast that may pass through the study area include gray, humpback, minke, and blue whales. These and other species that occur off the central California coast are listed in Table 3.4.3.1-3.

Pinniped species observed within the study area include the California sea lion, northern elephant seal, Steller sea lion, and northern fur seal. The California sea lion and northern fur seal are primarily within the study area during migration and while foraging (U.S. Navy 1993a). The other pinnipeds observed (harbor seal, elephant seal, and Steller sea lion) breed in the central California coast region.

Threatened, Endangered, and Sensitive Species

Threatened or endangered species that occur within the general area of the Ocean Section 102 site are listed in Table 3.4.3.1-4. Winter-run chinook salmon, a state listed endangered and federally listed threatened species, is primarily found over the continental shelf. Therefore, it is less likely to be found in the deeper waters of the proposed Ocean 102 site.

Two state and federally listed endangered bird species, the peregrine falcon and brown pelican, have been observed roosting (not nesting) at the Farallon Islands. Several peregrine falcons apparently winter on the Farallon Islands, and several individuals have been observed to the north and west of the islands (EPA 1993a). The majority of the brown pelicans were sighted foraging nearshore, over shallower shelf waters, although they were also observed over upper slope waters during calm weather (EPA 1993a; Ainley and Allen 1992; Jones and Szczepaniak 1992). Another endangered species, the short-tailed albatross, was observed over the continental slope offshore of Monterey Bay and off Cordell Bank, although its occurrence in the general area is quite rare (only two individuals spotted).

Most of the endangered cetacean species have never been observed within the study site, or have not been observed within the site in recent surveys. However, two species, the humpback whale and blue whale, have been observed in the Gulf of the Farallones or in shallower regions south of the Ocean 102 site. Humpback and blue whales are most abundant in the area during the summer and early fall. Gray whales, which have recently been removed from the federal endangered species list, were also observed within the Gulf of the Farallones, particularly near the northeast border of Study Area 5. However, gray whales generally are not sighted over deep waters, such as the slope where the Ocean 102 site is located. In past surveys, sperm and finback whales were observed within the study area, although they have not been observed in recent surveys (EPA 1993a; Ainley and Allen 1992; Jones and Szczepaniak 1992).

Table 3.4.3.1-1. Marine Birds (Slope and Pelagic Species) Observed off the California Coast
(page 1 of 2)

Common Name	Scientific Name	Occurrence Within Study Region	Seasonal Status	Relative Abundance	Predominant Habitat
Black-footed albatross	<i>Diomedea nigripes</i>	Seasonal Visitor	Summer	Common	Slope, pelagic
Laysan albatross	<i>Diomedea immutabilis</i>	Seasonal Visitor	Winter	Uncommon	Slope, pelagic
Short-tailed albatross	<i>Diomedea albatrus</i>	Seasonal Visitor	Winter	Rare	Shelf, slope
Cassin's auklet	<i>Ptychoramphus aleuticus</i>	Breeding	Year-round	Abundant	Slope
Rhinoceros auklet	<i>Cerorhinca monocerata</i>	Breeding	Year-round	Abundant	Shelf, slope, pelagic
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>	Breeding	Year-round	Abundant	Shelf
Peregrine falcon	<i>Falco peregrinus</i>	Breeding	Year-round	Rare	Shelf, slope
Northern fulmar	<i>Fulmarus glacialis</i>	Seasonal Visitor	Winter	Abundant	Slope, pelagic
Pigeon guillemot	<i>Cephus columba</i>	Breeding	Summer	Common	Shelf
Bonaparte's gull	<i>Larus philadelphia</i>	Passage Migrant	Winter	Abundant	Shelf
California gull	<i>Larus californicus</i>	Seasonal Visitor	Winter	Abundant	Shelf, slope
Glaucous-winged gull	<i>Larus glaucescens</i>	Seasonal Visitor	Winter	Common	Shelf, slope
Herring gull	<i>L. argentatus</i>	Seasonal Visitor	Winter	Common	Slope, pelagic
Sabine's gull	<i>Larus sabini</i>	Passage Migrant	Winter	Uncommon	Pelagic
Thayer's gull	<i>Larus thayeri</i>	Seasonal Visitor	Winter	Uncommon	Slope, pelagic
Western gull	<i>Larus occidentalis</i>	Breeding	Year-round	Abundant	Shelf, slope
Long-tailed jaeger	<i>Stercorarius langicaudus</i>	Passage Migrant	Winter	Rare	Slope, pelagic
Parasitic jaeger	<i>Stercorarius parasiticus</i>	Seasonal Visitor	Winter	Uncommon	Shelf, slope, pelagic
Pomarine jaeger	<i>Stercorarius pomarinus</i>	Seasonal Visitor	Winter	Uncommon	Shelf, slope, pelagic
Black-legged kittiwake	<i>Rissa tridactyla</i>	Seasonal Visitor	Winter	Uncommon	Slope, pelagic
Arctic (Pacific) loon	<i>Gavia pacifica</i>	Passage Migrant	Winter	Abundant	Shelf, slope
Common murre	<i>Uria aalge</i>	Breeding	Year-round	Abundant	Shelf, slope

Table 3.4.3.1-1. Marine Birds (Slope and Pelagic Species) Observed off the California Coast
(page 2 of 2)

3.4-19

<i>Common Name</i>	<i>Scientific Name</i>	<i>Occurrence Within Study Region</i>	<i>Seasonal Status</i>	<i>Relative Abundance</i>	<i>Predominant Habitat</i>
Xantus' murrelet	<i>Endomychura hypoleuca</i>	Seasonal Visitor	Winter	Rare	Slope, pelagic
Cook's petrel	<i>Pterodroma cooki</i>	Seasonal Visitor	Summer	Uncommon	Pelagic
Murphy's petrel	<i>Pterodroma ultima</i>	Seasonal Visitor	Summer	Uncommon	Pelagic
Ashy storm-petrel	<i>Oceanodroma homochroa</i>	Breeding	Year-round	Common	Pelagic
Black storm-petrel	<i>Oceanodroma melania</i>	Seasonal Visitor	Winter	Irregular (numerous at sporadic intervals)	Pelagic
Fork-tailed storm-petrel	<i>Oceanodroma furcata</i>	Seasonal Visitor	Winter	Irregular (numerous at sporadic intervals)	Pelagic
Leach's storm-petrel	<i>Oceanodroma leucorhoa</i>	Breeding	Summer	Uncommon	Pelagic
Red phalarope	<i>Phalaropus fulicarius</i>	Passage Migrant	Winter	Abundant	Shelf, slope, pelagic
Horned puffin	<i>Fratercula corniculata</i>	Seasonal Visitor	Summer	Uncommon	Slope, pelagic
Tufted puffin	<i>Fratercula cirrhata</i>	Breeding	Year-round	Uncommon	Slope
Black-vented shearwater	<i>Puffinus opisthomelas</i>	Seasonal Visitor	Winter	Irregular (numerous at sporadic intervals)	Shelf, slope
Buller's shearwater	<i>Puffinus bulleri</i>	Passage Migrant	Winter	Common	Slope, pelagic
Pink-footed shearwater	<i>Puffinus creatopus</i>	Seasonal Visitor	Summer	Common	Shelf, slope
Short-tailed shearwater	<i>Puffinus tenuirostris</i>	Seasonal Visitor	Winter	Uncommon	Shelf, slope
Sooty shearwater	<i>Puffinus griseus</i>	Seasonal Visitor	Summer	Abundant	Shelf, slope
South polar skua	<i>Catharacta maccormicki</i>	Seasonal Visitor	Summer	Rare	Shelf, slope, pelagic
Arctic tern	<i>Sterna paradisaea</i>	Passage Migrant	Winter	Common	Slope, pelagic
Common tern	<i>Sterna hirundo</i>	Passage Migrant	Winter	Uncommon	Shelf, slope

Table 3.4.3.1-2. Densities of Marine Mammals and Key Marine Bird Species within Study Area 5 (EPA 1993a).

	STUDY AREA 5		
	A	B	C
Bird Species			
Ashy storm-petrel	M	L	N
Western gull	L	L	L to M
Common murre	M to H	M	N
Sooty shearwater	M to H	M	L
Cassin's auklet	L to H	M	L
Rhinoceros auklet	L to H	L to M	L
Pink-footed shearwater	*	N	L
Tufted puffin	L	N	N
Cetacean Species			
Pacific white-sided dolphin	*	L	L
Dall's porpoise	*	N	L
Pinniped Species			
California sea lion	*	N	L
Northern elephant seal	*	L	N
Steller sea lion		N	L
Northern fur seal	*	L	N

Notes: N = None observed
L = Low density
M = Medium density
H = High density
* = No data collected

Sources: Data from A (Ainley and Brockelheide 1990); B (Ainley and Allen 1992); and C (Jones and Szczepaniak 1992).

Table 3.4.3.1-3. Cetacean Species Observed over Slope Areas Offshore Central California (Adapted from EPA 1992)

Common Name	Scientific Name	Activity Within Study Region	Seasonal Status	Relative Occurrence	Predominant Habitat
Blue whale	<i>Balaenoptera musculus</i>	Seasonal visitor	Summer	Uncommon	Shelf, slope
Finback whale	<i>B. physalus</i>	Migrant	Summer	Rare	Shelf, slope, pelagic
Gray whale	<i>Eschrichtius robustus</i>	Seasonal visitor/ Migrant	Year-round	Common	Shelf, slope
Humpback whale	<i>Megaptera novaeangliae</i>	Seasonal Visitor	Summer	Common	Shelf, slope
Killer whale	<i>Orcinus orca</i>	?	Year-round	Uncommon	Shelf, slope
Minke whale	<i>B. acutorostrata</i>	Seasonal Visitor	Summer	Common	Shelf, slope
Pilot whale	<i>Globicephala</i> spp.	Migrant	Winter	Uncommon	Slope, pelagic
Sperm whale	<i>Physeter macrocephalus</i>	Incidental	Year-round	Common	Slope, pelagic
Dall's porpoise	<i>Phocoenoides dalli</i>	Breeding	Year-round	Abundant	Shelf, slope
Northern right whale dolphin	<i>Lissodelphis borealis</i>	Breeding	Year-round	Common	Shelf, slope
Pacific white-sided dolphin	<i>Lagenorhynchus obliquidens</i>	Breeding	Year-round	Abundant	Slope, pelagic
Risso's dolphin	<i>Grampus griseus</i>	Seasonal Visitor	Year-round	Abundant	Shelf, slope

Notes: Abundant = over 5,000 individuals
Common = 1,000 - 5,000 individuals
Uncommon = 100 - 1,000 individuals
Rare = < 100 individuals

Table 3.4.3.1-4. Threatened and Endangered Species Occurring in the Vicinity of the Ocean Section 102 Site (Modified from EPA 1992)

<i>Common Name</i>	<i>Scientific Name</i>	<i>Status</i>
FISH		
Winter-run chinook salmon	<i>Onchorhyncus tshawytscha</i>	SE, FT
BIRDS		
Peregrine falcon	<i>Falco peregrinus</i>	SE, FE
California brown pelican	<i>Pelecanus occidentalis californicus</i>	SE, FE
MAMMALS		
Cetacean Species		
Humpback whale	<i>Megaptera novaeangliae</i>	FE
Blue whale	<i>Balaenoptera musculus</i>	FE
Finback whale	<i>Balaenoptera physalus</i>	FE
Sperm whale	<i>Physeter macrocephalus</i>	FE
Pinniped Species		
Steller sea lion	<i>Eumetopias jubatus</i>	FT

Notes: FE = Federally listed endangered
 FT = Federally listed threatened
 SE = State listed endangered
 ST = State listed threatened

Few Steller sea lions, which are listed as threatened, are expected to occur within the vicinity of the Ocean Section 102 site. Only one individual was spotted in the vicinity of the study area in recent studies (EPA 1993a; Jones and Szczepaniak 1992). Low densities (0.01-10 seals/km²) of the northern fur seal, which is considered depleted under the Marine Mammal Protection Act, were observed in deeper slope regions including Study Area 5.

3.4.3.2 Alcatraz

Plankton Community

Specific studies of the plankton community within the Alcatraz disposal site have not been conducted, but the community likely present may be inferred from various studies that have been performed throughout the Bay and estuary. The maximum abundance of phytoplankton at the site is most likely related to phytoplankton blooms offshore during periods of upwelling (spring and summer) (Cloern 1979). The most abundant phytoplankton tend to be coastal diatoms that have been dispersed into the bay, such as *Chaetoceros* spp., *Nitzschia* spp., *Rhizosolenia* spp., and *Skeletonema costatum*. Coastal dinoflagellates such as *Ceratium* sp. and *Peridinium* sp. are also likely to be present.

Copepods such as *Eurytemora affinis*, *Acartia clausi*, and *Acartia californiensis* are common within San Francisco Bay (Ambler et al. 1985). Fish larvae, and early development stages of crabs and shrimp such as *Cancer* sp. zoeae and *Crangon* sp., respectively, are likely to be within the disposal area. Larvae of various molluscs and polychaetes are also expected to be present.

Benthic Community

The benthic community at the Alcatraz Disposal Site is highly variable due to physical changes from both current disposal operations and dynamic tidal influences. The benthic organisms present tend to be opportunistic and characteristic of disturbed environments (SAIC 1987; COE 1988; COE 1992a). Reconnaissance level surveys conducted at the site in 1984 and early 1985 indicated high variation over time in dominant species present, species richness, and abundance (i.e., species richness decreased by one-half and abundance by 99 percent from October to February) (COE 1988). Surveys conducted in 1987 revealed opportunistic communities, although relatively long-lived and deeper dwelling organisms were present to the south of the disposal site (SAIC 1987; U.S. Navy 1990).

Dominant organisms observed at the site in October included the amphipods *Ampelisca abdita* and *Photis brevipes*. Nematodes, the bivalve *Tellina nukuloides*, and the polychaete *Glycera capitata* were also among the dominants. *Tellina nukuloides* was also abundant in February. Other dominants included the polychaetes *Armandia brevis*, *Glycinde polygnatha*, *Polydora brachycephala*, and *Heteromastus filiformis* (COE 1988, 1990, 1992a). All of these species serve as a potential food source to a variety of fish species present in the area. Epibenthic organisms of commercial value that are present within the area for at least part of the year include various bay shrimp (*Crangon* sp.), Dungeness crab (*Cancer magister*), and rock crabs (*Cancer antennarius* and *Cancer anthonyi*) (COE 1992a).

Fish Community

Otter trawl surveys conducted in 1984 and 1985 indicated a variety of fish species present in the Alcatraz disposal area. In the fall, pelagic fish species collected included shiner surfperch, longfin smelt, brown

rockfish, and plainfin midshipman. Northern anchovy, Pacific herring, white croaker, and longfin smelt were collected in the winter (February 1985). Demersal fish such as the English sole, staghorn sculpin, and big skate (*Raja binoculata*) were also collected. Migrating anadromous species such as chinook salmon and striped bass have also been observed passing through the disposal area (U.S. Navy 1990). The Northern anchovy and Pacific herring, which are only occasionally found at the site, are typical prey species of other fish such as the striped bass and salmon (EPA 1979; COE 1988). The Pacific herring are generally present at the site only during migration, and do not spawn at the disposal site (COE 1988). The presence of the English sole at the site is apparently transient as they generally appear in intertidal, shallow, and relatively quiet waters (COE 1988; U.S. Navy 1990).

Marine Birds and Mammals

Marine birds that may occur at the Alcatraz site are species common to San Francisco Bay and the nearshore coastal region outside of the Bay, such as cormorants, murrelets, scoters, grebes, pelicans, guillemots, and various gulls. Typical species occurring in the Bay in the vicinity of the Golden Gate bridge and coastal areas include Brandt's cormorants, surf scoters, western grebes, common murrelets, pigeon guillemots, and brown pelicans. Gull species likely occurring in the area are ring-billed, Bonaparte's, western, and California gulls. A breeding colony of black-crowned night herons occurs on Alcatraz Island. This species forages in tide pools along the shoreline of Alcatraz and other islands in the Bay, and is not expected to forage within the disposal site (COE 1992a).

Marine mammals that are found in the vicinity of the Alcatraz site include harbor seals, California sea lions, and harbor porpoises.

Threatened, Endangered, and Sensitive Species

State and federally endangered bird species that may occur in the vicinity of the Alcatraz disposal site include the California brown pelican and American peregrine falcon. Brown pelicans may forage within the area feeding on anchovies and other fish found within the disposal area. The peregrine falcon has begun nesting in the Central Bay; several pairs nest on the San Francisco-Oakland Bay Bridge (USFWS 1992), and could range in the vicinity of the Alcatraz disposal site in search of prey.

The winter-run chinook salmon (state endangered and federally threatened listed) may have a transitory presence within the Alcatraz disposal site as adults pass through San Francisco Bay to spawn upstream in the upper Sacramento River basin, and as juveniles make their way to the ocean. The salmon migration generally occurs from November to May, although this may vary slightly from year to year depending on the timing of juvenile smolt emigration, after which juveniles migrate to the ocean (COE 1992a). Migrating adults have also been caught in Suisun Bay in October (COE 1992a, Wang 1986).

3.4.3.3 Bay Farm Borrow Area

Plankton Community

Detailed surveys to describe the plankton community within the Bay Farm Borrow Area (BFBA) have not been conducted. However, species expected to be present within the area may be surmised from studies that have been performed within the South Bay area, and from various surveys of BFBA benthic and fish communities.

Studies of phytoplankton populations within the South Bay have shown a spring maximum in biomass, as occurs in the coastal and Central Bay areas. These studies were summarized in Cloern (1979). In some of the studies, the dominant species present were offshore diatoms (e.g., *Chaetoceros* spp.), which entered the Bay during coastal blooms associated with upwelling. In other years, there were relatively few coastal diatoms, while microflagellates (dinoflagellates, cryptophytes, and haptophytes) were predominant. It was postulated that the spring maximum where microflagellates were prevalent was due to periods in which river outflow was high, resulting in stratification of the water column. Due to the stratification, the phytoplankton tended to remain in the shallow surface layer, where growth was enhanced by increased exposure to sunlight.

Zooplankton likely to be present within the BFBA are larvae of benthic invertebrates and fish species observed during surveys conducted throughout the site (OBAI 1990, 1991; SAIC 1992a-d, 1993a). Juvenile anchovies (*Engraulis mordax*), gobies (Gobiidae), and flatfish (Pleuronectidae) were observed within the study area (SAIC 1993a). Early development stages (zoeae) of crabs are likely to be present, particularly those species for which both juveniles and adults were observed within the borrow area. Among these are red rock, Dungeness, and spider crabs (*Cancer productus*, *Cancer magister*, and *Majidae* sp.). During fish surveys conducted in 1993, ctenophores (comb jellies) were observed in some of the trawls (SAIC 1993a). Other organisms likely to be present include copepods, such as *Acartia* sp. and *Calanus* sp., that are common in the Bay, polychaete and mollusc larvae, and jellyfish.

Benthic Community

Physical, chemical, and biological surveys were conducted within and adjacent to the BFBA between November 1989 and August 1993 (OBAI 1990, 1991; SAIC 1993a). Stations sampled for benthic infauna were located in regions that differed in sediment type in and around the borrow area (representing ambient conditions around the borrow area), and within the borrow pit (Figure 3.4.3.3-1). Water quality and sediment quality results are described in section 3.2.

A total of 169 species were collected throughout the study area over one year of sampling, comprising 40 percent annelids (67 species), 27 percent crustaceans (46 species), 18 percent molluscs (31 species), and 15 percent miscellaneous taxa (including 6 echinoderm species and 5 nemertean species). Greatest fluctuations in species richness occurred in locations outside of the borrow area including the shallow mud bottom region containing shell lag deposits, located north and east of the borrow pit, and an eelgrass location in the shallow sandy region southeast of the BFBA (Table 3.4.3.3-1). Notable increases in richness tended to occur in the winter and spring. However, another location in the shallow sandy region increased in richness in the spring, but was relatively stable during other sampling periods. The stations located within the borrow pit and BFBA had minimal changes in richness following an initial increase in the winter.

Seasonal cycles in organism density were also apparent within the borrow area and some of the surrounding areas studied, with maximum densities occurring in the winter or spring and the lowest densities during the summer (Table 3.4.3.3-1). The borrow pit location and the sandy location southeast of the borrow area lacked a discernable seasonal pattern in abundance.

Diversity (as measured by the Shannon-Wiener Index and Pielou's Evenness Index) showed an apparent seasonal pattern at most stations, although these patterns were not consistent (Table 3.4.3.3-1). Most of the stations tended to have a peak in diversity in December followed by a low in diversity in February.

With the exception of the borrow pit station, another peak in diversity occurred at all stations in August 1992. The borrow pit station increased in diversity through the winter, and decreased during the remainder of the study. The absence of consistent patterns in temporal changes for diversity, as well as richness and total density, suggests that the communities throughout the borrow area are subject to stress so that seasonal cycles are interrupted (SAIC 1993a).

The most common species found throughout the study area is the polychaete *Exogone lourei*, a detritivore. The sabellid polychaete, *Euchone limnicola*, a suspension feeder, was among the dominants within the borrow area boundary throughout most of the study. Changes in its density at these stations appeared to be related to changes in sediment grain size, where densities increased with an increase in the sand fraction or a decrease in the silt or clay fraction. The maldanid polychaete, *Sabaco elongatus*, a deposit feeding tube dwelling bamboo worm, was also dominant within the borrow area to the west of the borrow pit.

The amphipod *Ampelisca abdita*, a filter feeding detritivore, was the most common crustacean, forming dense tube mats, during all seasons. Nichols and Thompson (1985 as cited in Nichols and Pamatmat 1988) found this species to be abundant in South Bay shallows. *Ampelisca abdita* had lowest abundance at the sandy area southeast of the borrow area. Another amphipod, *Corophium heteroceratum*, was dominant within the borrow pit. The tanaidacean, *Leptochelia dubia*, was abundant in the region north of the borrow area and at the eelgrass location. The amphipod *Grandidierella japonica* occurred among the dominant fauna at the eelgrass location when high silt and low sand percentages were present (August 1991 and May 1992).

Musculista senhousia was the most common mollusc species, although it was rare or absent in the shallow sandy area. Typical molluscs occurring at this location included the suspension feeding bivalves *Venerupis philippinarum* and *Gemma gemma*, species common in South Bay shallows (Nichols and Pamatmat 1988). These two species were also among the dominants at the eelgrass location. The limpet *Crepidula convexa* was abundant at the shallow station north of the borrow area. Brittle stars (*Amphipholis squamata* and Ophiuroid sp. 1) were also abundant at this location during August 1992. The phoronid (a tentaculate, wormlike, tube-dwelling organism) *Phoronis pallida* was dominant only in December at the eelgrass station.

Other species that were dominant during the study include the spionids *Polydora cornuta* and *Polydora socialis* (surface detritus feeders), amphipods of the genus *Corophium* (surface detritivores), and oligochaetes (subsurface deposit feeders). The cumacean *Nippoleucon* sp. 1, which is a surfacedetritus feeding crustacean, and the bivalves *Potamocorbula amurensis* and *Theora lubrica*, suspension feeders, were dominant only in the borrow pit.

Epifauna collected during the November 1990 surveys and caught incidentally in the gill-net in subsequent surveys included the herbivorous crabs of the family Majidae (spider crabs), and the carnivorous crabs *Cancer productus* within the borrow pit and *Cancer gracilis* and *Cancer jordani* to the west of the borrow pit. The shrimp, *Crangon* sp., and the spider crab, *Pyromaia tuberculata*, were caught in both locations. Hydroids and macroalgae were also abundant. Epifauna collected during trawl surveys conducted quarterly throughout the BFBA in 1993 included abundant hydroids and tunicates, various nudibranchs, sponges, shrimp (particularly, *Crangon* sp.), rock crabs (*Cancer productus* and *Cancer antennaris*), Dungeness crabs (*Cancer magister*), spider crabs (*Majidae* sp.), kelp crabs, and green shore and purple crabs (*Hemigrapsus oregonensis* and *Hemigrapsus nudus*, respectively) (SAIC 1993a).

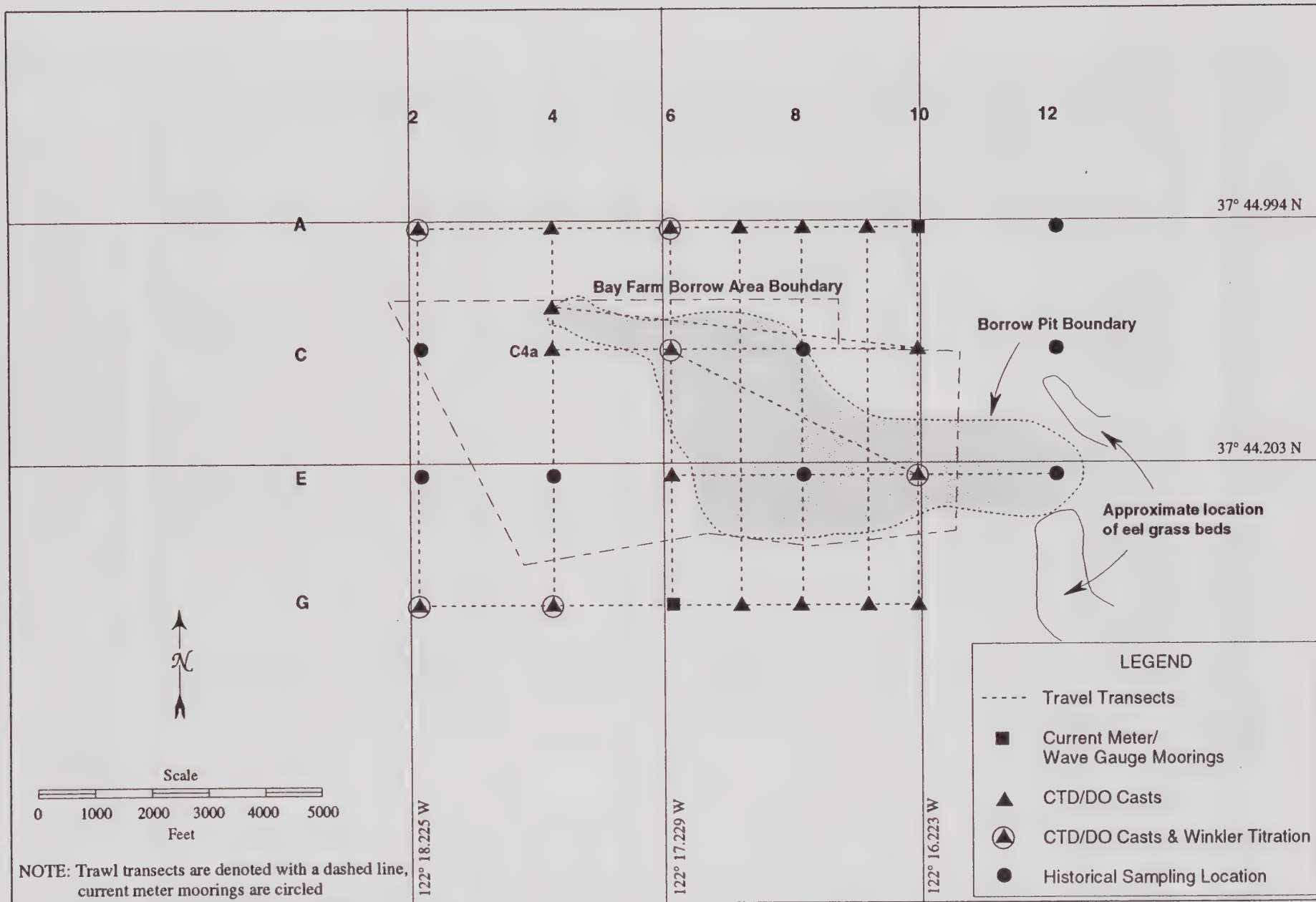


Figure 3.4.3.3-1

BAY FARM BORROW AREA SAMPLING GRID

Table 3.4.3.3-1. Summary of Benthic Community Indices Observed for Five Surveys Conducted in the Bay Farm Borrow Area, San Francisco Bay (Area sampled was 0.1 m²)

<i>Location and Date</i>	<i>Average Richness (No. of Taxa)</i>	<i>Average Abundance (No. of Individuals)</i>	<i>Average Density (No. of Ind./m²)</i>	<i>H'</i> *	<i>J'</i> **
Station A6					
August 1991	35.7	2059.3	20593	2.57	0.444
December 1991	51.3	2362.3	23623	2.98	0.487
February 1992	41.0	2248.7	22487	2.38	0.414
May 1992	46.7	3112.3	31123	2.89	0.482
August 1992	39.3	1160.0	11600	3.80	0.663
Station E4					
August 1991	30.0	2506.7	25067	1.25	0.223
December 1991	37.0	3299.0	32990	1.20	0.208
February 1992	35.0	4350.0	43500	1.06	0.183
May 1992	35.3	2815.7	28157	1.66	0.291
August 1992	33.7	1655.0	16550	1.95	0.346
Station G10					
August 1991	15.0	213.7	2137	1.59	0.323
December 1991	17.7	140.7	1407	2.06	0.428
February 1992	18.0	476.0	4760	1.02	0.214
May 1992	23.6	864.0	8640	3.09	0.573
August 1992	19.0	354.7	3547	3.11	0.629
Station Eelgrass					
August 1991	17.3	492.0	4920	2.43	0.490
December 1991	26.3	1181.3	11813	2.48	0.467
February 1992	25.7	1567.0	15670	2.22	0.445
May 1992	37.3	11141.7	111417	2.36	0.416
August 1992	31.3	785.0	7850	3.18	0.601
Station E8 - Borrow Pit Station					
August 1991	15.3	268.7	2687	2.85	0.605
December 1991	34.7	1637.7	16377	3.46	0.630
February 1992	35.0	955.7	9557	3.38	0.613
May 1992	31.3	1267.7	12677	3.44	0.633
August 1992	31.3	1273.3	12733	2.93	0.540

Notes: * Shannon-Wiener Diversity Index. Higher number indicates greater species diversity.
 ** Pielou's Evenness Index

Overall, the dominant infaunal species present at the borrow area tended to be surface suspension and detritus feeders. An exception would be to the west of the borrow pit (Station E4), which was dominated by the malvanid polychaete, *Sabaco elongatus*, a deeper-dwelling head-down deposit feeder. As indicated above, the dominant species present varied among stations (depth and sediment type), although some species were consistently abundant throughout the borrow area (e.g., *Exogone lourei*). Spider crabs, rock crabs (*Cancer* sp.), shrimp (*Crangon* sp.), hydroids, and tunicates were abundant epifauna in BFBA. Densities and richness tended to be higher in the winter than in the summer at some of the stations, although there were no consistent patterns throughout the study area. Similarly, there was a lack of consistent patterns in seasonal diversity changes among stations.

In addition to the seasonal surveys conducted throughout the BFBA between 1989 and 1993, observations were made of the biological community occurring in eelgrass beds located near the BFBA, during surveys conducted from 1985 to 1993 (Kitting 1993). The main eelgrass beds extend from approximately 1 km south of the borrow pit along Bay Farm Island. A few smaller beds exist to the north and south of these larger beds (Kitting 1993). Studies conducted using pushnets inside and outside of the eelgrass beds indicated variable populations of epibenthic fauna, including various amphipods (particularly *Caprella* sp.), shrimp (such as *Crangon* sp., although these were not concentrated among the vegetation), and molluscs (e.g., the bivalve *Gemma gemma*). Average epibenthic invertebrate population densities were greater than 1000 individuals per square meter during the surveys. In the last two years of surveys (1992 and 1993), eelgrass densities increased, with up to 12 plants per m². Maximum densities were observed between 1.5 and 2.0 feet (MLLW), and when water clarity was high. The associated invertebrate populations also increased during this period, potentially providing an abundant food source for fish and waterfowl.

Fish Community

Fish collections were made during the November 1990 survey using a 15 foot otter trawl (OBAI 1991), and during each of the five surveys from August 1991 to August 1992 using gill-nets (SAIC 1992 a-d; SAIC 1993a). Additional studies were recently conducted at the BFBA, and consisted of quarterly surveys from February to December 1993 (SAIC 1993b-e). The locations of each trawl and each station at which gill-nets were set are presented in Figures 3.4.3.3-1 and 3.3.3.3-1, respectively. Both types of sampling were conducted within and west of the borrow pit. In addition, fish populations were studied during the 1985 to 1993 surveys of the eelgrass beds located near the BFBA described above. Fish collected during the various surveys are discussed below.

Fish caught during the November 1990 survey included a pipefish (Syngnathidae) and one flatfish (Pleuronectidae) in the trawl through the borrow pit, and five unidentified juveniles in the trawl outside of the borrow pit. A total of 28 individuals representing eight species were caught during the quarterly cruises (August 1991 to 1992). The majority of the fish were caught within the borrow pit using the bottom net during these surveys. It was uncertain as to whether the bottom net was more effective in fishing than were the surface nets, or if the abundance of fish in the pit was greater than those in the surrounding areas.

Fish caught by gill net during the quarterly surveys included brown smoothhound sharks, white croakers, shiner surfperch, jacksmelt, bat rays, and leopard sharks, which are all common year-round residents of San Francisco Bay. Other fish captured included a sharpnose sculpin and Pacific herring. Pacific herring tends to be seasonal in abundance throughout San Francisco Bay as it returns to the estuary for spawning

in mid to late fall. Herring have been observed spawning in the eelgrass beds located southeast of the BFBA (Kitting 1993).

With the exception of the sharpnose sculpin, all fish captured during the surveys discussed above were again collected during the February through November 1993 trawl surveys. Tables 3.4.3.3-2 and 3.4.3.3-3 list the various fish species captured and total number of individuals captured during each of the four seasonal surveys (SAIC 1994). Among the most common demersal fish collected were sanddabs, English sole, yellowfin and bay gobies, staghorn sculpin, and California halibut. The most abundant pelagic species captured included northern anchovies (the predominant fish captured during all surveys), white croakers, shiner surfperch, topsmelt, and jacksmelt. Bay pipefish were also abundant throughout the surveys. All fish captured are typically common throughout San Francisco Bay (SAIC 1994, Armor and Herrgesell 1985).

Although only one year of trawl surveys were conducted, seasonal trends in the number of individuals captured, dominant species present, and faunal densities for the BFBA fish community were apparent. Size distributions of the dominant species present (e.g. white croakers and California halibut) varied, generally increasing through the year, with young of the year present starting in the May/June survey. Some species were present at the BFBA during all four surveys (e.g., northern anchovy, shiner surfperch, California halibut, bay gobies, and staghorn sculpin), although these varied in abundance throughout the study. Others such as California tonguefish, English sole, and white croakers were absent during one or more surveys, particularly in August. Presence or absence of a particular fish at the borrow area may be related to physical factors including salinity (varying according to river runoff) and water temperatures, or to availability of prey species. For example, English sole would more likely be present at the site during periods of high fresh water flow into the San Francisco Bay system (e.g., during spring or wet years), and other fish such as brown rockfish and dwarf surfperch may occur at the site when more marine conditions are prevalent at the site in the summer (SAIC 1994).

The diversity of the BFBA fish community varied throughout the surveys, with highest diversities in February and May/June and lowest in August. November diversities were intermediate. Diversities measured in August and November were relatively low for a coastal estuarine system, although overall, diversities observed at the BFBA (Shannon-Wiener Index = 0.66 to 1.74) were comparable to diversities obtained in other studies conducted in California coastal embayments and nearshore environs (SAIC 1994, Armor and Herrgesell 1985, Walters et al. 1985, Allen and Herbinson 1991). Densities of fish ranged from 93 fish/hectare to 307 fish/hectare, which was lower than those reported by Allen and Herbinson (1991) for studies along unprotected and semi-protected California coastlines (ranges were from 1988 individuals/hectare to 13,346 individuals/hectare).

Although the bottom conditions varied within the BFBA (e.g., deep soft-bottomed borrow pit and shallow regions with shell hash and mud or sandier substrates), it was difficult to determine if any zonation of the fish community based on substrate type, water depths, physiography, or benthic composition existed. As an artifact of sampling, data were too variable to determine significant differences. However, white croakers and blue-spotted shrimp (*Crangon nigromaculata*) tended to be more prevalent in the deeper waters, while California halibut were apparently more abundant in the shallower southern regions of the borrow area.

Table 3.4.3.3-2. Fish Collected within the Bay Farm Borrow Area

<i>Common Name</i>	<i>Scientific Name</i>	<i>General Habitat</i>
Brown smoothhound	<i>Mustelus henlei</i>	bottom
Leopard shark	<i>Triakis semifasciata</i>	bottom
Bat ray	<i>Myliobatus californica</i>	bottom
American shad	<i>Alosa sapidissima</i>	water column
Northern anchovy	<i>Engraulis mordax</i>	water column
Striped bass	<i>Morone saxatilis</i>	water column
White croaker	<i>Genyonemus lineatus</i>	water column
Pacific herring	<i>Clupea harengus pallasii</i>	water column
Topsmelt	<i>Atherinops affinis</i>	water column
Jacksmelt	<i>Atherinopsis californiensis</i>	water column
Longfin smelt	<i>Spirinchus thaleichthys</i>	water column
Night smelt	<i>Spirinchus starksi</i>	water column
Surf smelt	<i>Hypomesus pretiosus</i>	water column
Black surfperch	<i>Embiotica jacksoni</i>	water column
Barred surfperch	<i>Amphistichus argenteus</i>	water column
Dwarf surfperch	<i>Micrometrus minimus</i>	water column
Shiner surfperch	<i>Cymatogaster aggregata</i>	water column
Walleye surfperch	<i>Hyperprosopon argenteum</i>	water column
Bay goby	<i>Lepidogobius lepidus</i>	bottom
Chameleon goby	<i>Tridentiger trigonocephalus</i>	bottom
Cheekspot goby	<i>Ilypnus gilberti</i>	bottom
Yellowfin goby	<i>Acanthogobius flavimanus</i>	bottom
Crevice kelpfish	<i>Gibbonsia montereyensis</i>	bottom
Plainfin midshipman	<i>Porichthys notatus</i>	bottom
Bay pipefish	<i>Syngnathus leptorhynchus</i>	bottom
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	bottom
Sharpnose sculpin	<i>Clinocottus acuticeps</i>	bottom
Pacific tomcod	<i>Microgadus proximus</i>	bottom
California halibut	<i>Paralichthys californicus</i>	bottom
Pacific sanddab	<i>Citharichthys sordidus</i>	bottom
Speckled sanddab	<i>Citharichthys stigmaeus</i>	bottom
English sole	<i>Pleuronectes vetulus</i>	bottom
Hybrid sole	<i>Pleuronectidae</i>	bottom
Petrale sole	<i>Eopsetta jordani</i>	bottom
Sand sole	<i>Psettichthys melanostictus</i>	bottom
California tonguefish	<i>Symphurus atricauda</i>	bottom
Diamond turbot	<i>Hypsopsetta guttulata</i>	bottom

Table 3.4.3.3-3. Species and Numbers of Fish Captured during All Seasonal Surveys of the Bay Farm Borrow Area

<i>Fish Species</i>	<i>February</i>	<i>May/June</i>	<i>August</i>	<i>November</i>
Northern Anchovy	1116	3150	2816	1911
Striped Bass	7	0	0	4
White Croaker	70	2393	0	27
Bay Goby	0	539	16	6
Chameleon Goby	2	13	0	13
Cheekspot Goby	1	33	81	127
Yellowfin Goby	29	19	14	77
Juvenile Goby	278	96	12	39
Pacific Herring	0	2	2	2
Crevice Kelpfish	0	0	1	0
Plainfin Midshipman	0	6	52	69
Bay Pipefish	24	17	140	171
Brown Rockfish	0	22	39	21
Staghorn Sculpin	13	823	12	4
American Shad	7	0	0	7
Jacksmelt	10	20	0	2
Topsmelt	24	0	27	0
Longfin Smelt	4	0	0	1
Night Smelt	3	3	0	0
Surf Smelt	2	0	0	0
Barred Surfperch	1	1	0	0
Black Surfperch	0	0	0	1
Dwarf Surfperch	0	0	2	4
Indeterminate Surfperch	0	1	0	0
Shiner Surfperch	151	724	24	8
Walleye Surfperch	0	5	0	0
Pacific Tomcod	0	0	0	1
California Halibut	73	29	5	16
Pacific Sanddab	55	0	0	0
Speckled Sanddab	2	56	0	30
English Sole	68	358	0	0
Hybrid Sole	5	0	0	0
Petrale Sole	1	0	0	0
Sand Sole	1	0	0	0
California Tonguefish	1	106	0	1
Diamond Turbot	1	1	2	0
Indeterminate Righteyed Flatfish	5	0	0	0
Brown Smoothhound	0	1	0	0
Leopard Shark	1	1	0	1
Bat Ray	0	1	0	4
TOTALS	1955	8420	3245	2547

Generally, the fish collected within the BFBA are carnivores, feeding upon soft-bottom benthic infauna and epifauna. Smoothhound sharks, leopard sharks, and bat rays feed mainly on crabs and shrimps, and may feed on small fishes, clams, polychaetes, and tunicates. Bay pipefish consume epibenthic isopods and amphipods. Surfperch, white croakers, smelts, sculpins, and flatfish (e.g., English sole, California halibut, sanddabs, etc.) generally feed on various small crustaceans (e.g., amphipods, isopods, cumaceans), polychaetes, and small fish. Shiner surfperch also feed on mussels and algae. The amphipod *Ampelisca abdita*, an important prey species for both fish and likely shrimp, was particularly abundant in the spring when numerous fish and young of the year were present, implying that juveniles may be foraging at the BFBA. Other potential prey abundant periodically at the borrow area include the black shrimp (*Crangon nigricauda*) and blue-spotted shrimp. These may serve as a food source to the staghorn sculpin, California halibut, brown smoothhound and leopard sharks, Pacific tomcod, and other fish known to consume crangonid shrimp (SAIC 1994, Siegfried 1989, Kucas and Hassler 1986). The fish in turn may serve as prey to the many marine birds and waterfowl observed in the vicinity of the borrow area and near by eelgrass beds, as well as the seals and sea lions observed at the BFBA.

Approximately 10 different fish species, including juveniles of seven species, have been observed among the eelgrass community southeast of the BFBA, during the surveys conducted in the area from 1985 to 1993 (Kitting 1993). Fish feed on the various invertebrates and other small fish associated with the eelgrass beds. Although some fish, such as surfperch and anchovies, may rely on the eelgrass beds for foraging, an increase in the eelgrass and invertebrate populations does not necessarily correspond to an increase in the fish population. During the most recent surveys, when eelgrass and invertebrate populations were highest, the fish populations declined from an average of two fish per m², one of the highest densities observed in California bays, to less than one fish per m². Therefore, Kitting indicated that, although the eelgrass beds provide a valuable source of food for the fish populations in San Francisco Bay, it is not the only limitation on abundances of fishes in the Bay.

Fish also use the eelgrass beds as a nursery and for spawning. As indicated above, various juvenile fish may be found among the eelgrass, such as topsmelt, jacksmelt, and striped bass. Herring have used these eelgrass beds as a spawning area. However, the herring have also been observed spawning on the drift algae, *Gracilaria* sp. (Kitting 1993).

Marine Mammals and Marine Birds

Marine mammal and bird observations were made concurrently with the physical and biological surveys conducted throughout the BFBA from August 1991 to November 1993 (SAIC 1992a-d and 1993 a-c). All avian and mammalian species observed during the surveys are listed in Table 3.4.3.3-4. The presence of bird species within the area varied seasonally. Migratory ducks such as surf scoters, lesser scaups, and western grebes were very abundant during winter months, and noticeably absent during summer surveys. A wintering waterfowl, the common loon, was also observed within the area during winter and spring surveys. Least terns, which breed in central and southern California during the spring, were present within the area during spring and summer surveys. Birds commonly observed year round at the site included Brandt's cormorants, western and California gulls, Forster's tern, and brown pelicans.

It is likely that the wintering waterfowl, gulls, cormorants, terns, and pelicans, forage within the borrow area and nearby eelgrass beds. Gulls, terns, cormorants, and pelicans are predominantly fish eaters but will also consume large crustaceans. Anchovies, jacksmelt, and topsmelt are likely targets for many of

the birds observed within the area. Scoters dive to feed mainly on mollusks and crustaceans, while grebes feed mainly on small fish.

Marine mammals sighted during the surveys (all seasons) were the California sea lion and the harbor seal. Seals and sea lions were observed feeding on fish within the study area.

Threatened, Endangered, and Sensitive Species

The California least tern and brown pelican are listed by both the state of California and the federal government as endangered. A breeding ground for least terns exists approximately 3 nautical miles south of the borrow area at a sandy upland site at the Oakland International Airport and at the runway apron at the NAS Alameda (COE 1992a) (Figure 3.4.1.1-1). The least tern has been observed within the borrow area primarily in the spring and summer during nesting periods, and are likely feeding within the vicinity of the borrow area during these periods. However, least terns generally migrate from the San Francisco Bay Area in August for the winter. Least terns generally eat planktivorous fish such as anchovies, silversides (topsmelt and jacksmelt), surfperches, and herring, all of which are found within the borrow area (U.S. Navy 1990). Brown pelicans may also be feeding on anchovies within the borrow area, which are a primary food source for the pelicans. Brown pelicans were observed year round in the vicinity of the borrow area. No brown pelican breeding occurs in the San Francisco Bay Area.

No threatened or endangered fish were captured at the BFBA, although the longfin smelt (*Spirinchus thaleichthys*) has been proposed for addition to the federal and state of California list of threatened or endangered species. Longfin smelt were present in low numbers ($n < 5$) during the February and November surveys of the BFBA.

3.4.3.4 Leonard Ranch/Redwood Landfill

Plant Communities and Wildlife Habitats

Plant communities and habitat types identified on site include agricultural field, seasonal wetland, coastal brackish marsh, and eucalyptus woodland (Figure 3.4.3.4-1; HLA 1993c). Northern coastal salt marsh occurs off site, south of the perimeter levee and adjacent to the proposed pipeline route. Plant compositions and habitat values for each of these communities are provided below.

AGRICULTURAL FIELD (178 ACRES). The site is currently under cultivation for oat hay (*Avena sativa*). Historic diking, draining, periodic disking, and planting of the crop have prevented the native community from becoming reestablished. In addition to the cultivated oat, plants typical of the agricultural field include birdfoot trefoil (*Lotus corniculatus*), yellow star-thistle (*Centaurea solstitialis*), mustard (*Brassica* spp.), radish (*Raphanus sativus*), and mayweed (*Anthemis cotula*). This hayfield community provides forage and cover for wildlife in the area. Typical mammals found in this field include granivores and grazers such as California meadow vole (*Microtus californicus*), black-tailed hare (*Lepus californicus*), and Columbian blacktail deer (*Odocoileus h. hemionus*). Red fox (*Vulpes vulpes*) was observed during field surveys and is the dominant terrestrial predator. This habitat is dominated by Brewer's blackbird (*Euphagus cyanocephalus*), house finch (*Carpodacus mexicanus*), and western meadowlark (*Sturnella neglecta*) (USFWS 1992). Shorebirds including gulls (*Larus* spp.), American avocet (*Recurvirostra americana*), and killdeer (*Charadrius vociferus*) also use these fields. Turkey vulture (*Cathartes aura*),

Table 3.4.3.3-4. Marine Bird and Mammal Species Observed within the Bay Farm Borrow Area

<i>Common Name</i>	<i>Scientific Name</i>
Bird Species	
Brandt's cormorant	<i>Phalacrocorax penicillatus</i>
Double-crested cormorant	<i>Phalacrocorax auritus</i>
Western grebe	<i>Aechmophorus occidentalis</i>
California gull	<i>Larus californicus</i>
Glaucous winged gull	<i>Larus glaucescens</i>
Herring gull	<i>Larus argentatus</i>
Mew gull	<i>Larus canus</i>
Ring-billed gull	<i>Larus delawarensis</i>
Western gull	<i>Larus occidentalis</i>
Ring-billed gull	<i>Larus delawarensis</i>
Common loon	<i>Gavia immer</i>
Brown pelican	<i>Pelecanus occidentalis californicus</i>
Ruddy duck	<i>Oxyura jamaicensis</i>
Sanderling	<i>Calidris alba</i>
Lesser scaup	<i>Aythya affinis</i>
Surf scoter	<i>Melanitta perspicillata</i>
Caspian tern	<i>Sterna caspia</i>
Forster's tern	<i>Sterna forsteri</i>
Least tern	<i>Sterna antillarum browni</i>
Mammals	
California sea lion	<i>Zalophus californianus</i>
Pacific harbor seal	<i>Phoca vitulina</i>

Setting -- Biological Resources

red-tailed hawk (*Buteo jamaicensis*), and northern harrier (*Circus cyaneus*) also occur commonly on site. Pacific gopher snake (*Pituophis malanoleucus catenifer*) and western fence lizard (*Sceloporus occidentalis*) also commonly occur in this habitat.

SEASONAL WETLAND (45 ACRES). Topographic lowlands distributed throughout the site pond water seasonally when rainfall exceeds runoff and infiltration rates. The extent and duration of ponding on site varies. Water may remain for several weeks following large storms to only a few hours after small storms. Water pumping also shortens the duration of ponding. During years when there is sufficient ponding to exclude the crop, naturalized (nonnative) plants associated with wetlands become established in topographic lows. Plants typical of these seasonal wetlands include lythrum (*Lythrum hyssopifolium*), toad rush (*Juncus bufonius*), perennial ryegrass (*Lolium perenne*), brass-buttons (*Cotula coronopifolia*), and spearscale (*Atriplex triangularis*).

Seasonal wetlands are important for migratory and resident wildlife. Wildlife values associated with these ponded areas are limited by cultivation practices such as disking, seeding, harvesting, and pumping water off site. USFWS reports that the seasonal wetlands on site provide "important seasonal wetland habitat values for numerous and diverse wildlife species" (White 1993). These values include winter resting habitat for migratory waterfowl and shorebirds of the Pacific Flyway; refuge areas for shorebirds during storms when high tides and winds cover adjacent mudflats and marshes; feeding, resting, and nesting habitat that supplements adjacent tidal areas; and year-round habitat for small mammals, raptors, game and passerine birds, and shorebirds. Feeding habitat values for waterfowl and shorebirds in seasonal wetlands are directly related to the frequency and duration of ponding. Blooms of invertebrates can quickly develop in ponded areas, providing a rich source of food for migratory birds. The abundance, size, and diversity of invertebrates in these pools increases as the duration of ponding lengthens. Considering the relatively short duration of ponding on site, the value of seasonal wetlands as feeding habitat for migratory waterfowl and shorebirds is low. Relatively few migratory waterfowl and shorebirds were recorded on site during a 1982 to 1989 census (USFWS 1992). The census showed that only 19 percent of the birds observed onsite were shorebirds and 2 percent were waterbirds. In addition to supporting wildlife typical of the agricultural fields, seasonal wetlands support amphibians such as the Pacific tree frog (*Hyla regilla*). However, the value of this habitat to wildlife at the Leonard Ranch site is relatively low due to cultivation practices on site. These practices include disking, seeding, harvesting, burning, and pumping water off site.

COASTAL BRACKISH MARSH (2 ACRES). The perimeter and interior ditches that drain the site contain brackish water that ponds for sufficient duration to support plants adapted to saline wetland conditions. Plants typically found in this community include prairie bulrush (*Scirpus robustus*), broad-leaved cattail (*Typha latifolia*), pickleweed (*Salicornia virginica*), alkali heath (*Frankenia salina*), and saltgrass (*Distichlis spicata*). This community provides forage and cover for a variety of wildlife taxa. Birds typical of this community include red-winged blackbird (*Agelaius phoeniceus*), black phoebe (*Sayornis nigricans*), and great egret (*Casmerodius albus*). Numerous California ground squirrels (*Spermophilus beecheyi*) and their burrows were observed along ditch banks.

EUCALYPTUS WOODLAND (1 ACRE). Two blue gum (*Eucalyptus globulus*) stands with sparse understories grow in the southeastern portion of the site. This woodland community has relatively low habitat value due to a lack of a well-developed understory. Raptors, including red-tailed and rough-legged hawk (*Buteo jamaicensis*, *B. lagopus*), use these trees for perching and vantage points. Passerine birds such

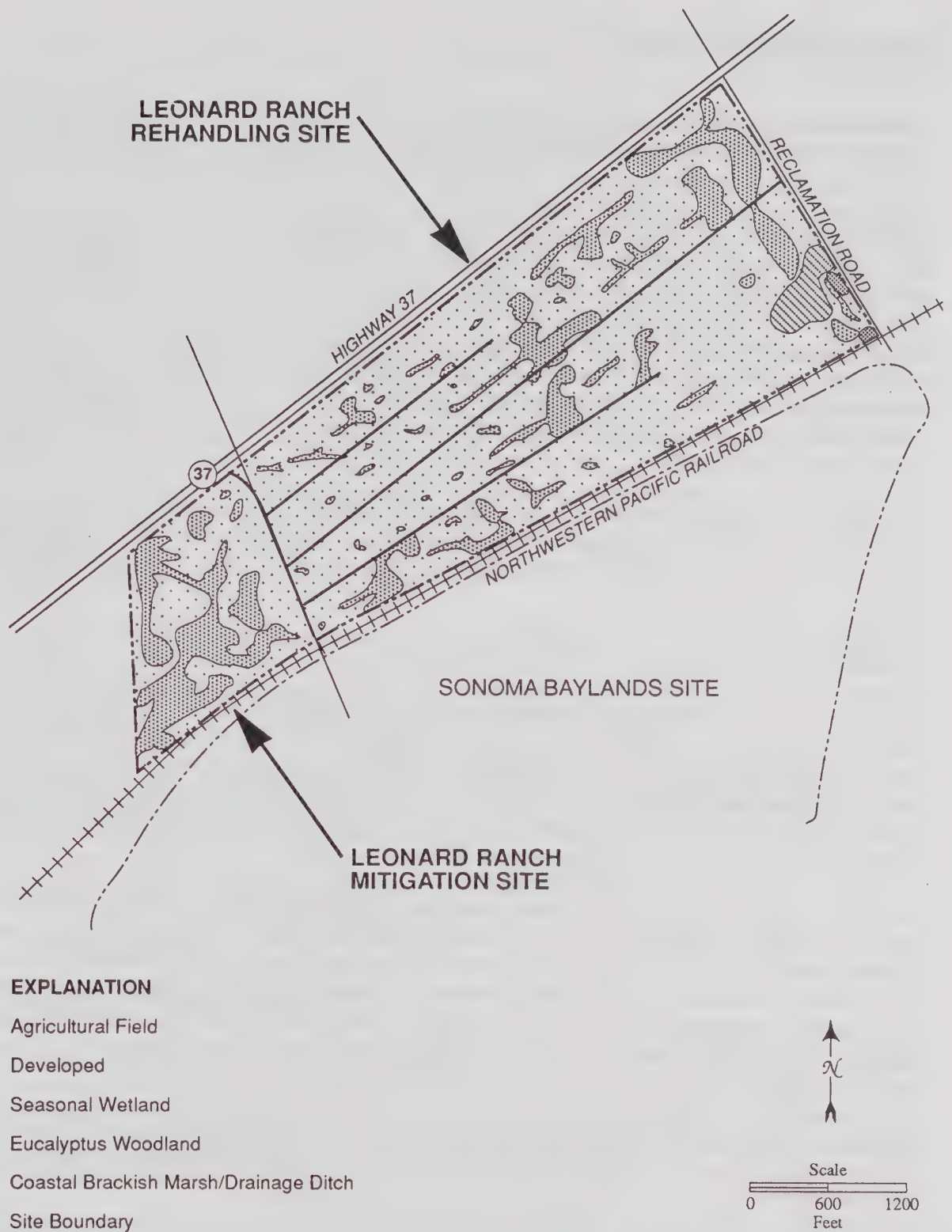


Figure 3.4.3.4-1

**PLANT COMMUNITY MAP, LEONARD RANCH REHANDLING SITE
AND LEONARD RANCH MITIGATION SITE**

as California towhee and mourning dove (*Zenaida macroura*) also perch and may nest in this woodland. The tree canopy provides thermal cover during hot days and cold nights for mammals such as black-tailed deer.

NORTHERN COASTAL SALT MARSH. Off-site areas south of the perimeter levee of the adjacent Sonoma Baylands property and both sides of the soil berm proposed for the overland pipeline route support extensive stands of northern coastal salt marsh. Plants typical of this community include saltgrass, pickleweed, and California cord grass (*Spartina foliosa*). Northern coastal saltmarsh is one of the most productive communities in the world, providing habitats for a diverse assemblage of aquatic and terrestrial life forms. Marshland plants are the primary producers that decompose to nourish a variety of microorganisms consumed in a complex web that feeds higher life forms. These organisms include aquatic forms such as molluscs, crustaceans, fish, and terrestrial forms such as insects, amphibians, reptiles, birds, and mammals.

Along San Francisco Bay, the areal extent of intertidal marshlands has declined dramatically as a result of agriculture, salt production, duck hunting, landfilling, and development. Of the estimated 194,370 acres of tidal marshland present in 1850, only 30,003 acres (15 percent) remained in 1989 (Dedrick 1989).

Special-Status Taxa

Relevant background information, including the California Natural Diversity Data Base (CDFG 1993), the California Native Plant Society's Inventory of Rare and Endangered Plants of California (Smith and Berg 1988), and correspondence with the USFWS (Pierce 1994), indicates that several special-status plant and animal taxa may occur in the project area. A summary of these taxa is provided in Appendix C, Table C-1. Botanical surveys of the site and proposed pipeline route were performed in July 1993 (HLA 1993c).

PLANTS. No special-status plants were observed on the project site. Seasonal wetlands provide marginally suitable habitat for several special-status plant taxa, including Baker's blennosperma (*Blennosperma bakeri*), Contra Costa goldfields (*Lasthenia conjugenus*), Petaluma popcorn flower (*Plagiobothrys mollis* var. *vertitus*), dwarf downingia (*Downingia humilis*), legenere (*Legenere limosa*), and Sebastopol meadowfoam (*Limnanthes vinculans*). During the July 1993 botanical survey, no remnant materials from these plants were observed. Given the disturbance regime of the site, it is very unlikely that these plants occur on site.

The coastal brackish marsh on site associated with drainage ditches provides marginally suitable habitat for the Delta tule pea (*Lathyrus jepsonii* ssp. *jepsonii*). It was not observed during the July 1993 botanical survey.

Northern coastal salt marsh along the proposed pipeline route provides suitable conditions for the growth of Point Reyes bird's beak (*Cordylanthus maritimus* ssp. *palustris*), soft bird's beak (*Cordylanthus mollis* ssp. *mollis*), saltmarsh bird's beak (*Cordylanthus maritimus* ssp. *maritimus*), and Marin knotweed (*Polygonum marinense*). None of these plants were observed within 20 feet on either side of the proposed pipeline route during the July 1993 botanical survey (HLA 1993c).

WILDLIFE. The study area provides potentially suitable habitats and lies within the ranges of known occurrence for at least eight special-status animals. These taxa are designated as having low, moderate, and high potentials of occurrence in the study area (see Table C-1 in Appendix C). The northern harrier was the only special-status animal observed in the study area during field surveys in July and August 1993 (HLA 1993c). Table C-1 lists an additional 19 special-status animals reported to occur on Petaluma Point and adjoining USGS quadrangle (CDFG 1993) or by Pierce (1994); these taxa are not expected to occur in the study area because it lacks key habitats or is outside the known range for each taxon.

The agricultural field and nonnative annual grassland provide suitable foraging habitat for northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), peregrine falcon (*Falco peregrinus anatum*), and tricolored blackbird (*Agelaius tricolor*). Brackish marsh along drainage ditches provide potential foraging and nesting habitat for the tricolored blackbird. Salt marsh habitat south along the proposed pipeline route provides suitable foraging habitat for California black rail (*Latterallus jamaicensis*), California clapper rail (*Rallus longirostris*), salt marsh yellowthroat (*Geothypis trichas sinuosa*), and San Pablo song sparrow (*Melospiza melodia samuelis*).

Special-Status Communities/Habitats

Coastal brackish marsh and northern coastal salt marsh are communities described by Holland (1986) and are considered rare enough to warrant inclusion in the state inventory of natural communities requiring monitoring or conservation efforts. These communities provide potentially suitable habitat for numerous special-status plant and animal taxa described above.

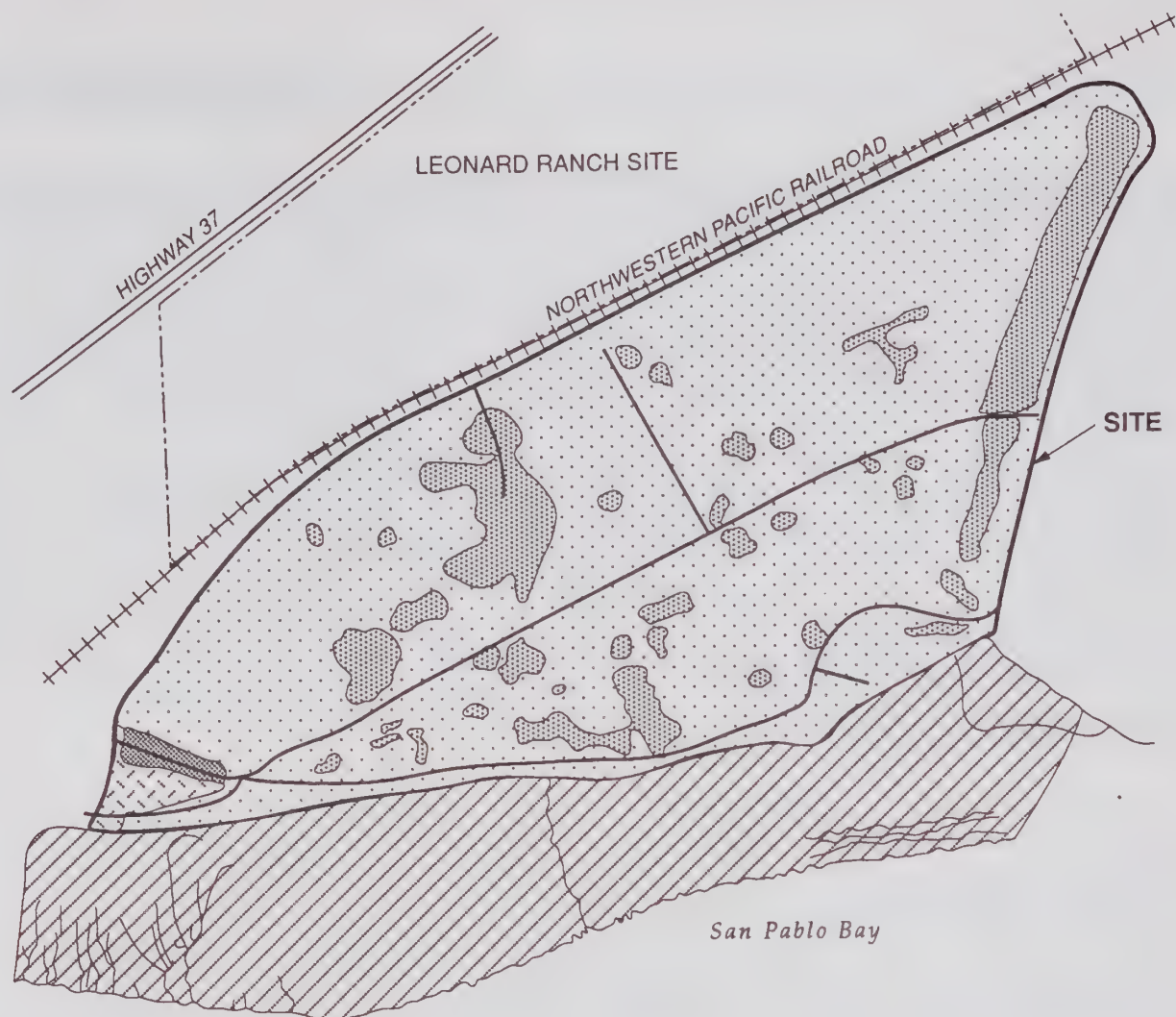
Seasonal wetlands and drainage ditches are considered waters of the United States and therefore receive protection under Section 404 of the Clean Water Act (33 U.S.C. Section 1344). Unfilled areas behind the levees that are below historic mean high-water mark are regulated under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Sections 402, 403). Approximately 47 acres and 7 acres of the site are within Section 404 and Section 10 jurisdictions, respectively (COE 1993f).

3.4.3.5 Sonoma Baylands

Plant Communities and Wildlife Habitats

Five plant communities identified on site include agricultural field, nonnative annual grassland, seasonal wetland, coastal brackish marsh, and eucalyptus woodland (Figure 3.4.3.5-1; HLA 1993c; COE 1993e; Sonoma Land Trust 1991). Northern coastal salt marsh occurs off site, south of the perimeter levee and adjacent to the proposed pipeline route. Plant composition and habitat values for each of these communities are provided below.

AGRICULTURAL FIELD (285 ACRES). The site is currently under cultivation for oat hay. Historic diking, draining, periodic disking, and planting of the crop have prevented the native community from becoming reestablished. In addition to the cultivated oat, plants typical of the agricultural field include birdfoot trefoil, yellow star-thistle, mustard, radish, and mayweed. The hayfield community provides forage and cover for wildlife that occur in the area. Typical mammals found in these fields include California meadow vole, black-tailed hare, and Columbian blacktail deer. Red fox was observed during field surveys. Birds typical of these fields include Brewer's blackbird, house finch, and western meadowlark. Pacific gopher snake and western fence lizard also commonly occur in this habitat.



EXPLANATION

-  Agricultural Field
-  Nonnative Annual Grassland
-  Seasonal Wetland
-  Northern Coastal Salt Marsh
-  Eucalyptus Woodland
-  Coastal Brackish Marsh/Drainage Ditch

SOURCE:
Corps, 1993
BCS, 1993
ENTRIX, Inc., 1991



Scale
0 600 1200
Feet

Figure 3.4.3.5-1

PLANT COMMUNITY MAP, SONOMA BAYLANDS SITE

NONNATIVE ANNUAL GRASSLAND (5 ACRES). Uncultivated uplands that support nonnative grassland on site include perimeter levees, a fallow portion of the field in the southwestern corner of the site, and the upland area along the proposed pipeline route. This community includes naturalized invasive plants such as mustard, wild oat, fennel, and brome. This community also includes discontinuous stands of coyote brush. Many of the same wildlife taxa inhabiting the agricultural fields also use the nonnative annual grassland. The relatively infrequent disturbance regime allows a relatively dense and tall grassland cover to develop in this community. Nesting, foraging, and cover are among the habitat values this community provides. Grasslands along the perimeter levees also provide transportation corridors, burrowing sites, and dryland refugia for wildlife inhabiting adjoining wetland areas.

SEASONAL WETLAND (55 ACRES). Topographically low areas distributed throughout the site pond water seasonally when rainfall exceeds runoff and soil infiltration. The extent and duration of ponding on site varies. Water may pond for several weeks following large storm events to only a few hours after small storms. Water pumping also reduces the duration of ponding. During years when there is sufficient ponding to exclude the crop, naturalized (nonnative) plants associated with wetlands become established in topographic lows. Plants typical of these seasonal wetlands include lythrum, toad rush, perennial ryegrass, brass-buttons, and spearscale. Wildlife values associated with these ponded areas are limited by cultivation practices such as disking, seeding, harvesting, and pumping water off site. USFWS reports that the seasonal wetlands on site provide "important seasonal wetland habitat values for numerous and diverse wildlife species" (White 1993). These values include winter resting habitat for migratory waterfowl and shorebirds of the Pacific Flyway; refuge areas for shorebirds during storms when high tides and winds cover adjacent mudflats and marshes; feeding, resting, and nesting habitat that supplements adjacent tidal areas; and year-round habitat for small mammals, raptors, game and passerine birds, and shorebirds. Feeding habitat values for waterfowl and shorebirds in seasonal wetlands are directly related to the frequency and duration of ponding. Blooms of invertebrates can quickly develop in ponded areas, providing a rich source of food for migratory birds. The abundance, size, and diversity of invertebrates in these pools increases as the duration of ponding lengthens. Considering the relative short duration of ponding on site, the value of seasonal wetlands as feeding habitat for migratory waterfowl and shorebirds is low. Relatively few migratory waterfowl and shorebirds were recorded on site during a 1982 to 1989 census (USFWS 1992). The census showed that only 19 percent of the birds observed onsite were shorebirds and 2 percent were waterbirds.

COASTAL BRACKISH MARSH (1.3 ACRES). Ditches that drain the site contain brackish water that ponds for sufficient duration to support plants adapted to moderately saline wetland conditions. Plants typically found in this community include prairie bulrush, broad-leaved cattail, pickleweed, alkali heath, and saltgrass. This community provides forage and cover for a variety of wildlife. Birds commonly observed in this community include red-winged blackbird, black phoebe, and great egret. Numerous California ground squirrels burrows are located along ditch banks.

EUCALYPTUS WOODLAND (1.7 ACRES). One stand of blue gum with a sparse understory grows in the southwestern portion of the site. Several golden wattle (*Acacia longifolia*) also occur in this woodland. This woodland community has relatively low habitat value due to a lack of a well-developed understory. Raptors, including red-tailed and rough-legged hawk, use these trees for nesting, perching, and as vantage points. Passerine birds such as California towhee and mourning dove also perch and may nest in this woodland. The tree canopy provides thermal cover during hot days and cold nights for mammals such as black-tailed deer.

NORTHERN COASTAL SALT MARSH. Off-site areas south of the existing perimeter levee and on both sides of the soil berm proposed as the overland pipeline route and inlet channel support extensive stands of northern coastal salt marsh. Plants typical of this community include saltgrass, pickleweed, marsh gumplant, and California cord grass. Refer to section 3.4.3.5 for habitat values and the extent of northern coastal saltmarsh in the San Francisco Bay region.

Special-Status Taxa

Relevant background information, including the California Natural Diversity Data Base (CDFG 1993), the California Native Plant Society's Inventory of Rare and Endangered Plants of California (Smith and Berg 1988), and correspondence with the USFWS (Pierce 1994) indicates that several special-status plant and animal taxa may occur in the project area. A summary of these taxa is provided in Appendix C, Table C-1.

PLANTS. Botanical surveys of the site and proposed pipeline route were performed in July 1993 (HLA 1993c). No special-status plants were observed on the project site. Seasonal wetlands provide marginally suitable habitat for several special-status plant taxa including Baker's blennosperma, Contra Costa goldfields, Petaluma popcorn flower, dwarf downingia, legene, and Sebastopol meadowfoam. During the July 1993 botanical survey, no remnant materials from these plants were observed. Given the disturbance regime of the site, it is considered very unlikely that these plants occur on site.

The coastal brackish marsh on site associated with drainage ditches provides marginally suitable habitat for the Delta tule pea. It was not observed during the July 1993 botanical survey.

Northern coastal salt marsh along the proposed pipeline route provides suitable conditions for the growth of Point Reyes bird's beak, soft bird's beak, salt marsh bird's beak, and Marin knotweed. None of these plants were observed within 20 feet on either side of the proposed pipeline route during the July 1993 botanical survey.

WILDLIFE. The study area provides potentially suitable habitats and lies within the ranges of known occurrence for at least eight special-status animals. These taxa are designated as having low, moderate, and high potentials of occurrence in the study area (see Table C-1 in Appendix C). The northern harrier was the only special-status animal observed in the study area during field surveys in July and August 1993 (HLA 1993). Table C-1 lists an additional 19 special-status animals reported to occur on the Petaluma Point and adjoining uses quadrangles (CDFG 1993) or by Pierce (1994); these taxa are not expected to occur in the study area, because it lacks key habitats or is outside the known range for each taxon.

The agricultural field and nonnative annual grassland provide suitable foraging habitat for northern harrier, burrowing owl, peregrine falcon, and tricolored blackbird. Brackish marsh along drainage ditches provide potential foraging and nesting habitat for the tricolored blackbird. Saltmarsh habitat south of the Sonoma Baylands site is expected to provide foraging habitat for California black rail, California clapper rail, salt marsh common yellowthroat, and San Pablo song sparrow.

Special-Status Communities/Habitats

Coastal brackish marsh and northern coastal salt marsh are communities described by Holland (1986) and are considered rare enough to warrant inclusion in the state inventory of natural communities requiring

monitoring or conservation efforts. The northern coastal brackish marsh is within Sonoma County's Biotic Resources Combining District. As a county-defined critical habitat area, mitigation measures may be required if the Planning Director determines that a discretionary project could adversely impact a designated critical habitat area. These communities provide potentially suitable habitat for numerous special-status plant and animal taxa described above.

Seasonal wetlands and drainage ditches are considered waters of the United States and therefore receive protection under Section 404 of the Clean Water Act (33 USC Section 1344). Unfilled areas behind the levees that are below historic mean high-water mark are regulated under Section 10 of the Rivers and Harbors Act of 1899 (33 USC Sections 402, 403). Approximately 56.3 acres and 41.4 acres of the site are within Section 404 and Section 10 jurisdictions, respectively (COE 1993e). To complete its restoration project, the Sonoma Land Trust has applied to the Department of the Army for authorization to discharge fill into these areas (COE 1993).

3.4.3.6 Galbraith Golf Course

The Galbraith Golf Course (golf course) is located on 169 acres adjacent to Metropolitan Oakland International Airport (MOIA) in the city of Oakland, California. The site is within the historical margins of marshland of San Francisco Bay (Nichols and Wright 1971) and was used as a landfill until the golf course was constructed in 1965. The site consists of gently rolling hills ranging in elevation from 3 to 20 feet above mean sea level (MSL) and has wide, tree-lined fairways and narrow roughs. Several small freshwater marshes have formed in topographic lowlands on site. Runoff from surrounding areas and within the golf course drains overland into one of two artificial tidal drainages that merge into a single, large channel central to the site. Midway along the large channel is a flap type tidal gate that regulates water flow to San Francisco Bay.

Plant Communities and Wildlife Habitats

Three plant communities identified on site include ornamental landscape, seasonal freshwater marsh, and northern coastal brackish marsh (Figure 3.4.3.6-1). Developed areas also occur on site associated with the club house, parking areas, and maintenance facilities.

ORNAMENTAL LANDSCAPE (150 ACRES). Cultivated turf grasses, shrubs, and trees dominate the landscape of the golf course that consists of fairways, greens, and tees. Typical naturalized grasses in upland areas include common barley (*Hordeum vulgare*), wild oat (*Avena fatua*), and perennial ryegrass (*Lolium perenne*). Summer mustard (*Brassica geniculata*), sweet fennel (*Foeniculum vulgare*), and curly dock (*Rumex crispus*) are common herbs in upland areas.

Wildlife use of landscaped portions of the golf course is limited to those species adapted to frequent disturbance and proximity to humans. Medium-sized mammals, such as raccoon (*Procyon lotor*) and striped skunk (*Mephitis mephitis*), and rodents including California ground squirrel, Norway rat (*Rattus norvegicus*), and California vole inhabit the golf course. Typical birds observed or expected to occur at the golf course include raptors such as American kestrel (*Falco sparverius*) and red-tailed hawk (*Buteo jamaicensis*), shorebirds such as killdeer (*Charadrius vociferus*) and great egret (*Casmerodius albus*), and passerine birds such as golden-crowned sparrow (*Zonotrichia atricapilla*), mourning dove, and Brewer's blackbird (*Euphagus cyanocephalus*).

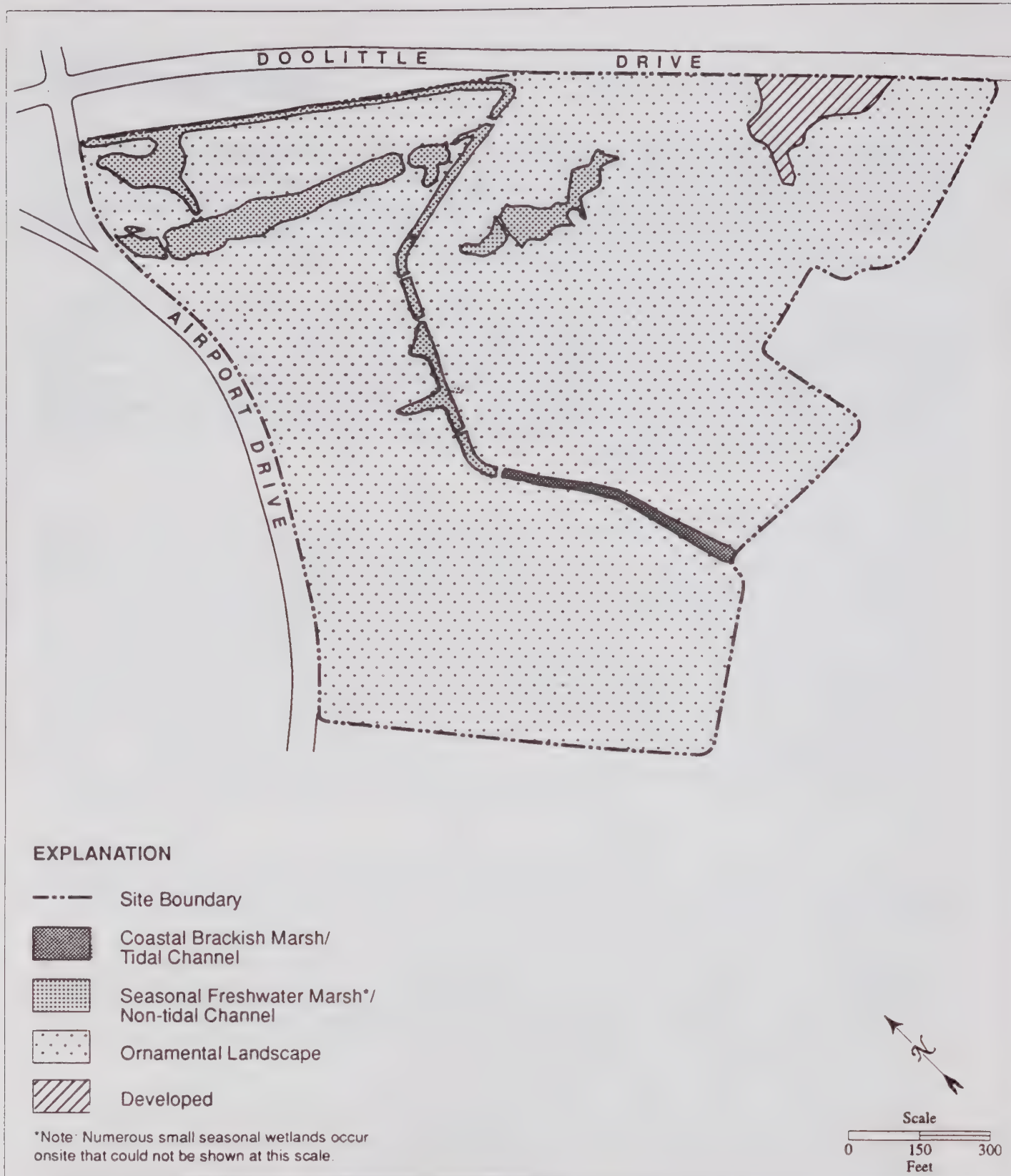


Figure 3.4.3.6-1
PLANT COMMUNITY MAP, GALBRAITH GOLF COURSE

SEASONAL FRESHWATER MARSH (12 ACRES). Seasonal freshwater marshes on site are dominated by salt grass (*Distichlis spicata*), rabbitsfoot grass (*Polypogon monspeliensis*), brass-buttons, and broad-leaved cattail. Seasonal wetlands are important for migratory and resident wildlife. These areas provide resting, breeding, drinking, and foraging habitat. In addition to supporting wildlife typical of the ornamental landscape, seasonal wetlands support amphibians such as the Pacific tree frog.

NORTHERN COASTAL BRACKISH MARSH (1 ACRE). Northern coastal brackish marsh on site associated with the drainage channel is colonized by pickleweed, salt marsh bulrush, and saltgrass. Wildlife using the brackish marshes include rodents such as house mouse (*Mus musculus*), Norway rat, and deer mouse (*Peromyscus maniculatus*); typical birds using this habitat include mallard (*Anas platyrhynchos*), killdeer, and western sandpiper (*Calidris mauri*).

Special-Status Taxa

Relevant background information, including the California Natural Diversity Data Base (CDFG 1993), the California Native Plant Society's Inventory of Rare and Endangered Plants of California (Smith and Berg 1988), and correspondence from the USFWS (White 1993b), indicates that several special-status plant and animal taxa may occur in the project area. Surveys for these taxa were conducted from June through August 1993 (H.T. Harvey and Associates 1993) (see Table C-2 in Appendix C).

PLANTS. Salt marsh gumplant (*Grindelia hirsutula* var. *hirsutula*) was the only rare plant observed on site. It is listed by the California Native Plant Society on list 4, which indicates it is not threatened or endangered. Approximately 300 to 400 plants grow along the banks of the tidal drainage channel in the south-central portion of the site. The tidal drainage channel provides potentially suitable habitat for several special-status plants, including Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*), soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*), small spikerush (*Eleocharis parvula*), delta tule pea (*Lathyrus jepsonii* ssp. *jepsonii*), hairless allocarya (*Plagiobothrys glaber*), and sea blite (*Suaeda californica*). These taxa were not observed during surveys and are assumed to be absent from the site. The site provides unsuitable habitat for numerous special-status plants reported to occur in the region, including Alameda manzanita (*Arctostaphylos pallida*), Presidio clarkia (*Clarkia franciscana*), Diablo helianthella (*Helianthella castanea*), Santa Cruz tarplant (*Holocarpha macradenia*), wedge-leaved horkelia (*Horkelia cuneata* ssp. *sericea*), Contra Costa goldfields (*Lasthenia conjugens*), Mason's lilaeopsis (*Lilaeopsis masonii*), adobe sanicle (*Sanicula maritima*). These taxa were not observed during surveys and are assumed to be absent from the site. Upland areas on site provide suitable habitat for California black walnut (*Juglans californica* var. *hindsii*). None were observed among the ornamental trees on site.

WILDLIFE. Several special-status animals have been observed at the golf course. Cooper's hawk (*Accipiter cooperi*) and burrowing owl (*Athene cunicularia*) have been observed foraging on site. Tricolored blackbird (*Agelaius tricolor*) has been observed on site during the winter. California gull (*Larus californicus*) occurs abundantly in the area and is expected to forage on site.

Special-Status Communities/Habitats

Historical filling activities and subsequent development of the golf course have destroyed much of the natural landscape and plant communities on site. Artificially created wetlands and remnant marshes on site would be afforded special-status consideration as wetlands (special aquatic sites) under federal law. Waters below the ordinary high-water mark and areas meeting federal wetlands criteria on site are subject

to regulation pursuant to Section 404 of the Clean Water Act (33 U.S.C. § 1344). Areas on site below the current and historical mean high-water levels would be subject to regulation pursuant to Section 10 of the Rivers and Harbors Act (33 U.S.C. § 403). The Corps has taken jurisdiction over approximately 12 acres of the golf course under Section 404 of the Clean Water Act. Given the proximity of the golf course to San Francisco Bay, any fill activity will require an Individual Permit. It will be necessary to demonstrate that there are no practicable alternatives to the proposed activity.

3.4.3.7 Port/Landfill

There are no biological resources associated with the Port/Landfill disposal option. The site is a paved terminal yard, supported on piles in the Oakland Inner Harbor. Biological resources for Oakland Harbor are discussed under section 3.4.2.

3.4.3.8 Montezuma Wetlands

Biological resources information for the Phase I portion of the Montezuma Wetlands site is based on Solano County's (1993) Administrative Draft EIR/S on the proposed development of Levine-Fricke's Montezuma Wetlands Project, application materials prepared by Levine-Fricke (1992, 1993), and the Corp's preliminary evaluation of Phase I of that project (personal communication, P. Baye).

The Montezuma Wetlands Project is located on a 2,000-acre parcel that is part of the Suisun Marsh system, representing approximately 12 percent of California's remaining wetland habitat. Lower areas of the marsh were probably dominated by tules, while higher marsh areas were probably dominated by irregular, diverse, and changeable plant communities of saltgrass, pickleweed, Baltic rush, spearscale, fleshy jaumea, and ecologically associated species.

The site was leveed as early as 1888 and has experienced varied uses over the last century, the foremost being cattle grazing and agriculture. Diking and agricultural practices have resulted in considerable land subsidence and habitat alteration and degradation. However, the area contains considerable acreage of seasonal wetlands, permanent water channels, and upland habitats that do provide fairly diverse, albeit fragmented, vegetation communities and associated wildlife habitat.

The assessment of existing vegetation and wildlife conditions on the site is based primarily on extensive documentation provided by Levine-Fricke (1992) and on discussions with resource agency personnel, reviews of published and unpublished literature and documents, and site visits.

Dr. Josh Collins (Levine-Fricke 1992) conducted an analysis of existing conditions on the site, including vegetation and wildlife, from a "landscape perspective." His analysis provided a description of spatial patterns of plant and animal communities in relation to major features of the landscape ("patch types"). Three important results of the landscape analysis were (1) due to differential subsidence, the landscape is inverted relative to historical conditions, (2) the historical drainage divides are now large saline basins that provide relatively high-value wildlife habitat, and (3) the site is a severely disturbed landscape. Extensive plant surveys were conducted by Jake Ruygt (Napa Botanical Surveys), birds surveys by Jules Evens and Rich Stallcup (Avocet Research Associates), and salt marsh harvest mouse surveys by Dr. Howard Shellhammer (California State University, Hayward). These studies (Levine-Fricke 1992) provide the most detailed documentation of vegetation and wildlife occurrence available for the site.

Plant Communities/Plant Patch Types. There are 16 "plant patch" types (subjectively classified mapping units of vegetation and wildlife habitat) within Phase I of the Montezuma Wetlands Project (Levine-Fricke 1992) (see Figure 3.4.3.8-1). Each of the plant patch types are described in Solano County (1993, Appendix 5) and their acreages are given in Solano County (1993, Appendix 8). Solano County (1993, Appendix 6) provides a list of all plant species observed on surveys conducted by Jake Ruygt (Levine-Fricke 1992); the list also provides each plant's wetland indicator status (e.g., obligate, facultative, etc.). Phase I of the project is dominated (89 percent of area) by patch types with low vegetative cover (introduced grassland/bare around; introduced grassland; base ground/introduced salt tolerant annuals; and *Spergularia/Cotula/Sesuvium*/bare around) and supports relatively few wetland species. Phase I has fewer wetland plants and more upland plants than the other project phases (Levine-Fricke 1992). The upland construction area is comprised predominately of introduced grassland.

Vegetation on the site has also been classified by the USFWS under the National Wetland Inventory classification system using aerial photography from 1985. This classification employed different criteria than the Levine-Fricke study, and was intended to identify wetlands at a larger scale with less detail. The distribution of habitat types on the project site are given in Solano County (1993). Most of the restoration site area as either palustrine farmed or palustrine emergent seasonally flooded. These types of habitats are considered to have wetland values, especially during winter/spring periods. Out of 786 acres within Phase I, 724 acres fall under Corps jurisdiction as wetlands and other waters of the United States.

Wildlife

Habitats in Phase I of the Montezuma Wetlands site, while highly disturbed, provide important seasonal wetland values for waterfowl and shorebirds, primarily in the saline basins scattered over the site. Numerous special status bird species were observed on the site, including the resident burrowing owl, that breeds on the site. Little is known of amphibian and reptile use of the area, but western pond turtles (a federal candidate species) may occur in ponded habitats. Potential habitat for the endangered salt marsh harvest mouse exists in areas of dense pickleweed; there are few such areas in Phase I (Figure 3.4.3.8-1, patch types 17, 31).

AVIFAUNA. Avifaunal surveys were conducted by Jules Evens and Rich Stallcup between April 16, 1991 and March 1, 1992 (Levine-Fricke 1992) and covered the breeding, migratory and wintering seasons. Solano County (1993, Appendix 9) lists the 89 bird species observed on the surveys, their relative abundance and seasonal occurrence. Of the 89 species, 53 percent were terrestrial, 36 percent aquatic, and 11 percent palustrine. Over half (51 percent) of the birds were migrants.

The distribution and abundance of birds was related to the habitat patch types described above. Seven avian habitat groups were developed by combining the habitat patch types into habitat components (Solano County 1993, Figure 49 and Appendix 8) deemed relevant for the avifauna (Levine-Fricke 1992). The list of observed species includes the avian habitat groups in which the birds were observed and their foraging guild; Solano County (1993, Appendix 10) breaks this overall taxonomic list into occurrence by habitat group.

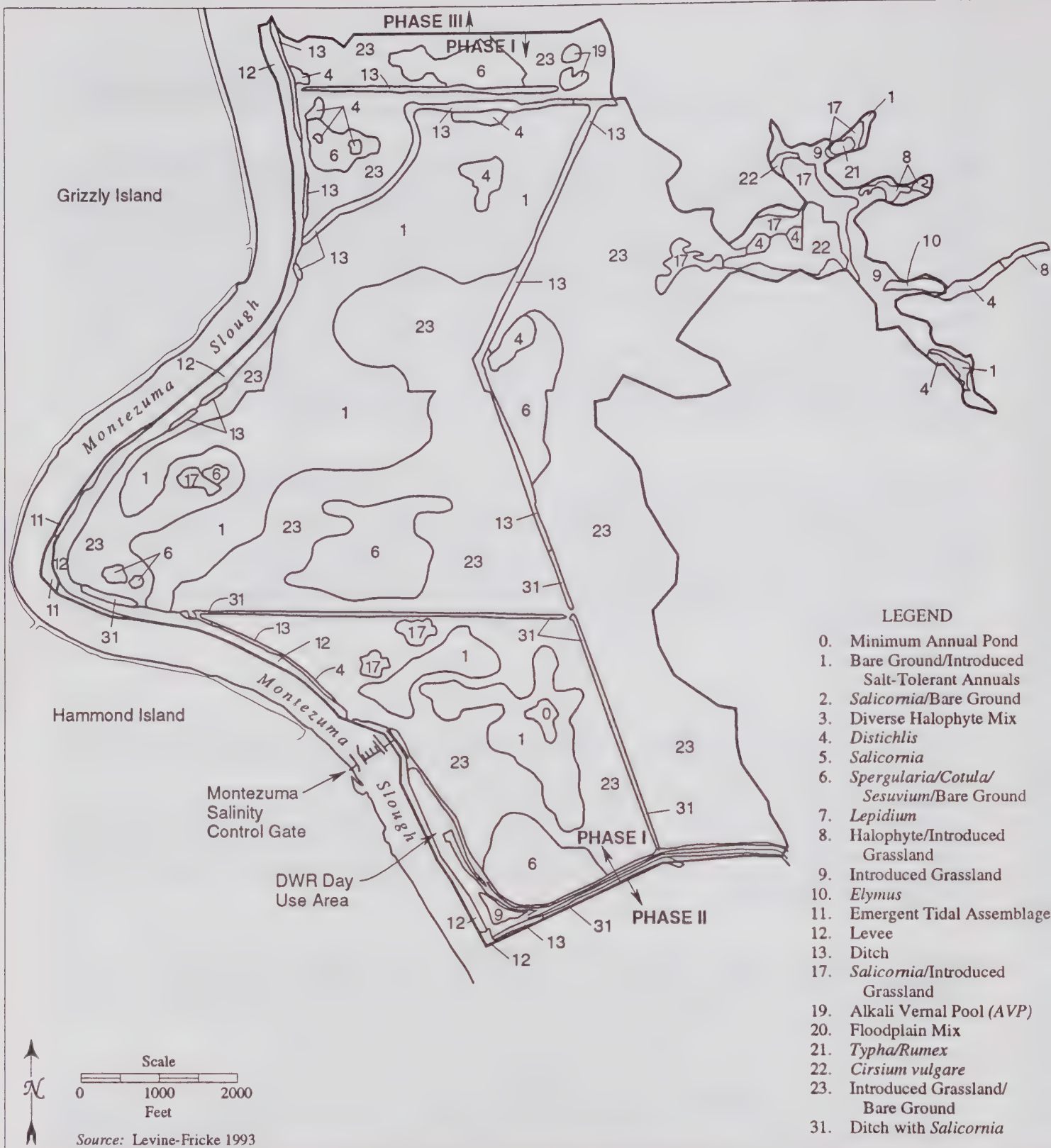


Figure 3.4.3.8-1

PLANT COMMUNITY MAP, MONTEZUMA WETLANDS (PHASE I) SITE

1 AVIAN HABITAT GROUPS. Although there are large differences in the acreage of the seven avian habitat
2 groups, overall annual use was roughly uniform among the habitat groups. The data indicate that the
3 relatively small aquatic and palustrine habitat patches supported considerably higher densities and species
4 per unit area than the larger mixed-halophyte and upland patches (Levine-Fricke 1992).

5
6 Most of the migratory species were associated with the saline basin (represented in Phase I by a single
7 1.2-acre pond), levee boundary thicket (19.6 acres in Phase I), and mixed halophyte-grassland (563 acres
8 in Phase I avian habitat groups -- as defined by Levine-Fricke [1992]). Migratory waterfowl and
9 shorebirds used the saline basins, and passerines used the levee boundary thickets. Raptors, migratory
10 shorebirds, and passerines were found in the mixed halophyte-grassland; this diversity reflects seasonal
11 variation in habitat values for these species within this habitat group.

12
13 The site is adjacent to large expanses of habitat managed specifically for waterfowl that may contribute
14 to the high numbers and diversity of waterfowl observed on the site. Waterfowl were observed primarily
15 in the saline basins and also in other open water areas on the site; these areas are poorly represented in
16 Phase I. Northern pintails and northern shovelers accounted for more than half of the dabbling ducks
17 observed. Mallards and gadwall breed in small numbers on the site.

18
19 Because shorebirds are less common in the Suisun Marsh than in the other portion of the Bay that have
20 extensive mudflats, the site received relatively less use than other seasonal wetlands in the Bay. For
21 example, a single flock of 1,200 long-billed dowitchers accounted for the majority of shorebirds observed
22 in spring of 1992. Dowitchers, western sandpipers, and dunlin were the most common shorebirds
23 observed. Shorebirds were found in the saline basins, and this habitat is very important for both
24 waterfowl and shorebirds on the Montezuma Wetlands site.

25
26 Ten species of diurnal raptors and three species of owls were observed on the avian surveys. The most
27 common diurnal raptors were black-shouldered kites, northern harriers, and American kestrels.
28 Burrowing owls, a special status species, are known to breed on site (see below). These raptors forage
29 on prey ranging from insects, small mammals, to birds and are thus found in habitats across the site.

30
31 The most diverse assemblage of land birds were found in the patch types emergent tidal ecotone and levee
32 boundary thickets. These habitats support resident populations and provide important migratory and
33 dispersal corridors. Common breeding land birds are horned lark, western meadowlark, and savannah
34 sparrow. Several special status land bird species have been observed on the site.

35
36 REPTILES AND AMPHIBIANS. No specific reptile and amphibian surveys have been conducted on the
37 Montezuma Wetlands site (Levine-Fricke 1992). However, the ditches, farm ponds, and vernal pools
38 provide suitable habitat for amphibians and some reptiles and the uplands habitat for reptiles.

39
40 Observations made during other survey work found "several western pond turtles" (a federal candidate
41 species) in areas of standing water on the site (Levine-Fricke 1992); the report also states that no evidence
42 was found of California tiger salamander (CDFG Species of Special Concern), California red-legged frog
43 (CDFG Species of Special Concern and Federal Candidate Species), western spadefoot toad (CDFG
44 Species of Special Concern), or giant garter snake (State Threatened, Federal Proposed Endangered).
45 However, the site is within the historic range of these species. Although heavy grazing pressure, other
46 disturbance factors, and water quality effects may decrease habitat values on the site for these species,

surveys by a qualified biologist at the appropriate season are recommended for these special status amphibians and reptiles that could occur on the site.

MAMMALS. Formal surveys for mammals were performed only for the federally and state-listed endangered salt marsh harvest mouse (Levine-Fricke 1992). Levine-Fricke (1992) reported 11 native mammals observed on the site: California ground squirrels, pocket gophers, western and salt marsh harvest mice, deer mice, California voles, black-tailed hares, Audubon cottontail rabbit, raccoon, coyote, and river otter (the latter in Montezuma Slough).

The five species of small mammals provide prey for larger mammalian predators and large raptors, and the abundant raptors observed on the site (Levine-Fricke 1992, a site visit), suggests that populations of small mammals may be quite dense in some habitats.

The Montezuma Slough levee, and several observed game trails, may provide travel and dispersal corridors for mammals moving across the site. Overall, aside from that by small mammals, mammalian use of the site is not considered high (Levine-Fricke 1992). This is due to the fragmentation of habitats, the isolation of the site from nearby high-quality habitats, and the degraded nature of existing habitats.

SPECIAL STATUS PLANT SPECIES. Sensitive plant species surveys were conducted on the site by Jake Ruygt (Napa Botanical Survey Services) in 1991 (April through September). A complete list of sensitive plant species that were observed on the project site, those that were surveyed for, but not found, and species that could potentially occur on the project site but for which surveys were not conducted is available in the administrative Draft EIR/S (Solano County 1993). Levine-Fricke (1992) lists sensitive plant species that could potentially occur or are known to occur on or near the Montezuma Wetlands site. Locations of these species on the site are indicated on the vegetation maps within Levine-Fricke (1992). Additional sensitive plant species surveys were conducted on the site during 1993, and the resulting data will be incorporated into the Final SEIR/EIS for this project.

Mason's lilaeopsis is the only legally protected plant species that has been found on the site. This species is found along the outboard levee of phases I, II, and IV. Within Phase I, four other special status species were found that are not legally protected; two of these species (San Joaquin saltbush and dwarf peppergrass) occur within the wetland restoration or construction areas. The former is found in the upland portion of Phase I; the latter in two patches (one upland, one lowland) in Phase I. The other two special status, but not legally protected plants, heart-leaved saltbush and delta tule pea, were found along the perimeter levee.

SENSITIVE BIRD SPECIES. Twenty-three special status bird species were either observed or may potentially occur on or near the Montezuma Wetlands Project site, including all phases (Solano County 1993, Appendix 11). They are burrowing owl, white pelican, California gull, double crested cormorant, black-crowned night heron, American bittern, northern harrier, ferruginous hawk, golden eagle, loggerhead shrike, yellow warbler, saltmarsh yellowthroat, Suisun song sparrow, tricolored blackbird, and horned lark. No species listed as threatened or endangered was observed on the site. One federal candidate species, the burrowing owl, was observed on the site; four to six pairs nested in burrows in banks on interior drainage ditches and perimeter levees. Because not all of the potential habitat was searched, additional surveys should be conducted by a qualified biologist prior to wetland restoration of each project phase and associated construction.

Two other candidate species, American white pelican and California gull, were seen nearby. Twelve species that lack legal protection were observed on the site or nearby; most were in the levee boundary thicket, emergent tidal ecotone, Montezuma Slough, or mixed halophyte and grassland. A few of the species listed in Solano County (1993, Appendix 11) are known from historical records, but no longer occur in the vicinity of the site (clapper and black rails). Several of the observed special status species were associated more closely with tidal marshes in the area (e.g., Suisun song sparrow).

MAMMALS. The only legally protected animal species known to occur on the Montezuma Wetlands Project site is the northern subspecies of the salt marsh harvest mouse (*Reithrodontomys raviventris halicoetes*). No salt marsh harvest mouse populations were detected or expected in Phase 1. Adverse impacts to this species would be likely in Phase 2, and especially in Phases 3 and 4, which support more extensive suitable habitat.

3.5 CULTURAL RESOURCES

3.5.1 Regulatory Setting

Cultural resources include remains of previous human activity that are archaeological (artifacts found on or within the ground) or are historical (standing architectural features, structures, or natural landmarks used over time). Evaluation and treatment of cultural resources potentially affected by the proposed project are mandated under federal and state statutes including Section 106 of the National Historic Preservation Act, Executive Order 11593, and the Advisory Council on Historic Preservation Regulations (CFR Part 800); and CEQA Appendix G, Significant Effects, and Appendix K, Archaeological Resources.

The proposed project's Area of Potential Effect (APE) would include any area where project activities could affect the ground surface or sea bottom where potentially significant cultural resources may be located, including Native American religious sites, archaeological sites, and potentially historic structures. Examples of areas considered would include those disturbed during dredged material disposal (berming, etc.), those where disposal materials are placed, new construction roads, pipelines and other utility corridors, and construction equipment staging areas.

Federal and state criteria are used for evaluating the significance of cultural resources. The federal significance criteria for defining cultural resource significance for eligibility for listing on the National Register of Historic Places are established by the National Park Service (36 CFR 60.4). These criteria pertain to projects with federal funding and/or jurisdiction. According to the National Register criteria, a significant cultural resource has integrity and contains one of the following qualities:

- A. Is associated with events that have made a significant contribution to the broad patterns of history; or
- B. Is associated with the lives of persons significant in the past; or
- C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. Have yielded, or may be likely to yield, information important in prehistory or history.

CEQA Appendix K, Archaeological Resources, states that an important, or significant, archaeological resource is one that:

- A. Is associated with an event or person of:
 - 1. Recognized significance in California or American history; or
 - 2. Recognized scientific importance in prehistory.

- B. Can provide information which is both of demonstrable public interest and useful in addressing scientifically consequential and reasonable or archaeological research questions;
- C. Has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind;
- D. Is at least 100 years old and possesses substantial stratigraphic integrity; or
- E. Involves important research questions that historical research has shown can be answered only with archaeological methods.

3.5.2 Regional

The optional disposal sites, except for the Montezuma Wetlands, are located within the San Francisco Bay and San Pablo Bay Region. The bay has filled a depression formed in the late Pliocene, which was repeatedly flooded during subsequent Pleistocene interglacials. As sea level rose during the Early Holocene from 421 feet below present sea level 15,000 years before present (B.P.) to 59 feet below present sea level at 7000 B.P., marine waters began to infiltrate the bay at a rate of approximately 0.5 inch/year (Moratto 1984). By 6000 B.P., the rate of sea level rise had slowed to approximately 0.05 inch/year. The Ocean Section 102 site would have been submerged during this period of time, but Alcatraz and Bay Farm Borrow Area sites would have been on exposed landforms.

This sea level change has affected the archaeological record. Any archaeological sites located on Early Holocene bay shores probably have been buried deeply under sediments, which has limited the understanding of prehistoric occupation distributions prior to 8000 B.P. Additional sedimentation was caused by bay marshland creation. Marshland surrounding the bay probably was first established beginning 3000 B.P., but was constantly being affected by changing directions of tributaries carrying additional sediment in the basin (Moratto 1984). This process of infilling also would have buried sites along the estuary margin. Archaeological sites from the Paleo-Indian Period, the earliest cultural horizon in California, could exist below these sediments, though their numbers are expected to be very low based on the overall distribution of sites throughout California from this time.

The Montezuma Wetlands site is located within the Sacramento Valley area of the Central Valley Region (Moratto 1984). This area is characterized by valley bottomlands subject to tidal or seasonal flooding, with dense wetland vegetation that would have provided food, fiber, and building materials to prehistoric populations. A Lower Sonoran grassland, or prairie, predominated between the extensive waterways. These resource-rich habitats were, however, lacking in stone tool materials, leading to prehistoric trade with adjacent regions (Moratto 1984).

The earliest archaeological sites in the San Francisco Bay region date from approximately 7000 B.P. These sites are associated with the Late Archaic period (7000 to 4000 B.P.), a time when populations, though still sparse, were increasing throughout California and a greater variety of environments were being exploited (Chartkoff and Chartkoff 1984). Artifacts including projectile points and ground stone implements indicate that hunting and collection of vegetable resources were important, along with shellfish collection. In the Sacramento River Delta region, this cultural expression is known as the

1 Windmill Pattern, dating from approximately 5,500 to 2,500 B.P. (Chartkoff and Chartkoff 1984,
2 Moratto 1984).

3
4 By 4000 B.P., populations were more numerous adjacent to bayshore and marsh habitats. Habitation sites
5 along the San Francisco Bay became more plentiful as people extended around the southern end of the
6 bay, continuing northward onto the Peninsula, and then westward to the coast and southward into the
7 Santa Clara Valley. Settlements from this Berkeley Pattern were situated to maximize exploitation of a
8 variety of food resources found along coastal or bayshore marshlands. Populations continued to increase,
9 which led to trade, social ranking within village groups, and status differentiation. Berkeley Pattern
10 archaeological sites often contain deep, stratified deposits from repeated occupation over generations.
11 Scholars believe that population growth created pressures on available resources; these pressures were
12 reduced as smaller groups broke off from parent settlements and established occupations in nearby
13 locations with greater resources (Moratto 1984). Artifact types are more diverse, reflecting the use of
14 a greater number of food resources.

15
16 In the Sacramento Valley, the Berkeley Pattern appeared later, around 2,500 B.P., and lasted until about
17 1,500 years ago. The locations of Berkeley Pattern sites are variable but are commonly adjacent to
18 riparian habitats (Solano County 1993).

19
20 Archaeological sites dating between 1,700 to 1,500 B.P. display an increasing complexity in artifact style
21 known as the Augustine Pattern. The bow and arrow is one aspect of this intensive fishing, hunting and
22 gathering pattern, which is associated with larger and denser populations. Over time, trade intensified
23 with the development of clamshell disk beads as money. The elaboration of the Augustine Pattern may
24 reflect the expansion of Patwin Indian groups southward into the lower Sacramento Valley and the San
25 Francisco Bay, displacing Bay Miwok (Moratto 1984).

26
27 This cultural tradition was disrupted by the Spanish Mission system, which subsequently led to a 95
28 percent reduction in the Indian population between 1770 and 1790 (Chartkoff and Chartkoff 1984).
29 Missions in the project area included San Francisco de Asis (1776), San Jose (1797), San Rafael
30 Archangel (1817), and San Francisco Solano (Sonoma) (1823) (Chartkoff and Chartkoff 1984). Mexico's
31 independence from Spain in 1822 resulted in the secularization of the Missions in 1834. Surviving
32 Mission Indian populations were employed "as virtual serfs on the feudalist haciendas" on the large land
33 grants owned by influential Mexican families (Chartkoff and Chartkoff 1984).

34
35 The California Gold Rush of 1849 resulted in San Francisco's development as a home for peoples from
36 throughout the world. The promise of riches attracted many ethnic groups, who often settled in their own
37 mining camps (Chartkoff and Chartkoff 1984). A three-tiered system evolved of small mining camps,
38 small regional cities along major rivers of the Central Valley (i.e., Sacramento and Stockton), and the
39 main center of San Francisco. The Sacramento and San Joaquin rivers were used as highways to convey
40 goods from the towns to San Francisco. Though rail transportation developed over the last half of the
41 19th century, allowing development to radiate away from the established pattern along waterways, the
42 San Francisco Bay maintained its importance as a regional import and export location (Chartkoff and
43 Chartkoff 1984).

3.5.3 Oakland Harbor

Prior to 1874 and its development as a navigable channel, the project site was submerged as part of the San Antonio Creek Estuary (COE 1988). Because human populations used the Bay Area throughout the Holocene Period, the estuary area could have been occupied before the sea level rise and sedimentation infilling created modern landforms. Excavation for harbor construction, however, would have disturbed and destroyed any cultural resources that existed. In previously undisturbed areas where development is proposed (e.g., utility relocations), evidence of Early Holocene occupation could still remain. Additionally, the estuary was the location of historic shipwrecks dating from the 19th century. Many ships were abandoned in the Inner Harbor's eastern end due to a decline in maritime trade following the California Gold Rush. Vessels including hulks, steam schooners, and whalers were left in disrepair and neglected (COE 1984).

A Works Progress Administration project begun in the 1930s was directed at removing ships within the Inner Harbor. The project's goal was to clear the navigable waters of visible obstacles (COE 1984). It is unclear whether the project actions also removed submerged vessels or fragments, although any known impediment to navigation was probably a focus of the effort. It is possible, though unlikely, that remains of sunken vessels remain in the harbor.

The project site has been evaluated previously by the Corps cultural resource staff (COE 1988); no physical structures or remains within the proposed dredging area that qualified for listing on the National Register of Historic Places were identified.

The training walls of the Oakland Inner Harbor contain segments of the original North and South Jetties constructed by the Corps of Engineers between 1876 and 1896 (Lerner 1990). The structures were repaired shortly after their establishment. Built at a 1.5 to 1 slope, they have remained functional for nearly a century in spite of the increasing stresses placed on them. Due to their association with the initial dredging and development of Oakland Harbor, and the fact that they have retained their character and their historical context clearly identified, the Jetties are considered eligible for inclusion in the National Register of Historic Places (Lerner 1990).

3.5.4 Disposal Site Options

3.5.4.1 Ocean Section 102

No archaeological or historical sites have been recorded within the alternative site area, based on a review of the California Archaeological Inventory, the National Register of Historic Places, the California Inventory of Historic Resources, and the "Submerged Cultural Assessment" published by the NOAA and the EPA (1993a).

3.5.4.2 Alcatraz

There are no historic resources recorded within this alternative site area, based on a review of the National Register of Historic Places and the California Inventory of Historic Resources. No known shipwrecks are identified in the project vicinity on the databases of the Northwest Information Center for the California Archaeological Inventory, the National Maritime Museum, National Park Service, or Minerals Management Service, U.S. Department of the Interior (COE 1988). The alternative site has

1 been used for disposal of dredged materials since the 1930s (COE 1984). Since 1972, the site has
2 received over 30 million tons of dredged material. This disposal activity has probably buried any cultural
3 resources that may have existed in the area prior to the disposal activity (U.S. Navy 1990).
4

5 **3.5.4.3 Bay Farm Borrow Area**

6
7 The alternative site is an historic borrow pit with depths of up to 50 feet. Excavation occurred in the
8 1950s and removed approximately 20 million cy of material (PTI 1989). No historic marine
9 archaeological remains, including shipwrecks, are known within this site (PTI 1989). It is likely that
10 borrow pit excavation would have removed any cultural resources that may have been deposited either
11 prehistorically or historically.
12

13 **3.5.4.4 Leonard Ranch/Redwood Landfill**

14
15 A cultural resources record search conducted by personnel at the California Archaeological Inventory,
16 Northwest Information Center, indicated that there are no recorded archaeological sites within the
17 Leonard Ranch site boundary. However, the Leonard Ranch site has not been surveyed for cultural
18 resources. Three prehistoric archaeological sites (CA-SON-0204, -0205, and -0206) are recorded
19 approximately 1/2 to 1 mile north of the Leonard Ranch site. These sites were identified by Nelson in
20 the early 1900s, and their precise location is not known. Due to the presence of known sites in the
21 vicinity, there is a potential for archaeological remains to be present at the alternative site. Farming done
22 on the site since approximately 1900 would have affected the vertical context of any prehistoric cultural
23 resources that potentially occur on the site. Site-specific surveys would be required if Leonard Ranch
24 were selected as part of the preferred disposal alternative; identified sites would be evaluated if impacts
25 were anticipated. The single-family dwelling and associated outbuildings appear to be part of a turn-of-
26 the-century farmstead. The structures are in poor condition and represent local vernacular architecture.
27

28 **3.5.4.5 Sonoma Baylands**

29
30 Prior to 1900, the site area was tidal wetland. Around 1900, the area was diked, drained, and converted
31 to agricultural uses. The site currently is used to grow hay.
32

33 The entire 348-acre disposal site was surveyed by archaeologists in November 1990 to identify prehistoric
34 or historic cultural resources (Jordan 1990). No evidence of either prehistoric or historic cultural
35 resources was encountered.
36

37 **3.5.4.6 Galbraith Golf Course**

38
39 This area is currently an operating golf course. A cursory field survey was accomplished in 1991 by
40 inspecting the few small areas of nonvegetated terrain. It appeared that the golf course was developed
41 on top of a former landfill that in turn covered bay fill. No archaeological or historic resources were
42 observed, and it is unlikely that any intact significant cultural resources occur on the property.
43
44

3.5.4.7 Port/Landfill

There are no cultural resources associated with the Port/Landfill disposal option. The site is a paved terminal yard, supported on piles in the Oakland Inner Harbor. Cultural resources for Oakland Harbor are discussed under section 3.5.3.

3.5.4.8 Montezuma Wetlands

The project site is within an area of the San Joaquin River Delta that has been subject to extensive archaeological and historical research. The earliest known populations occupied the area approximately 5,000 years ago, and numerous archaeological sites have been found that date between 1,500 and 500 years ago (Solano County 1993).

The earliest historic use of the property dates from the large livestock ranching and wheat cultivation operation of Emery Upham (1865-1897). A period of intensive land reclamation, including levee construction, was begun by Upham and continued into the early 20th century (1875-1930) to increase arable land area and reduce flooding hazards. Subsequent to Upham's death, his holdings were subdivided. One of these parcels, owned by A.M. Merrill, was called the Montezuma Ranch. After experimentation with various crops, Merrill devoted his ranch to cattle raising and stockyard (1912-1970s), which were made economically feasible by construction in 1913 of the Oakland-Antioch-Eastern Railroad Company rail line from Sacramento to Oakland. Over the years, the Montezuma Ranch changed ownership while maintaining the stockyard activity. At its peak, up to 50,000 head of cattle were penned annually at the Collinsville facility (Solano County 1993).

An intensive cultural resource investigation of the project site included review of existing archaeological records at the California Archaeological Inventory, Northwest Information Center, Sonoma State University and determined that one prehistoric village site (CA-SOL-34) had been previously destroyed by historic grading (Solano County 1993). An additional survey conducted in transects a maximum of 30 meters apart identified one additional prehistoric site and 13 historic sites.

The prehistoric site (CA-SOL-365) consists of an obsidian projectile point and Tule elk remains and is considered to date from between 2,500 to 150 years ago (Solano County 1993). All surface remains were collected.

Six of the historic sites date from the Upham Ranch period (ca. 1865-1897), four date from land reclamation and levee construction (ca. 1875-1930s), two date from the Montezuma Ranch (ca. 1929-present), and one is associated with the Oakland-Antioch-Eastern Railroad and Montezuma Station (1913-1927) (Solano County 1993). These historic deposits include residential refuse (glass bottles and fragments, ceramics, tin cans, bones), structural elements (pumphouse, wood, concrete pads, railroad tracks, trestles), and agricultural implements (hay bailer, thrasher) that illustrate the changing land uses within the alternative site over time.

According to Levine-Fricke, the Phase I disposal area contains two of these resources: an historic artifact scatter and railroad depot remains, M-2 and M-17, respectively. M-2 dates from the Upham Period. M-17 was associated with the Montezuma Ranch stockyard operation. The railroad depot is part of the Oakland-Antioch-Eastern Railroad Company, extended to the site in 1913.

1 The two sites are associated with a major use of the area in the 20th century and are representative of
2 a regional development during this time in the Sacramento Valley. Archival research would be required
3 to determine whether these surviving remains are unique to the region. The subsurface extent of the
4 archaeological sites is unknown. The sites are considered potentially significant under National Register
5 of Historic Places criteria A, B, C, or D and CEQA Appendix G (j), and CEQA Appendix K criterion
6 A, pending evaluation and consultation with the California State Historic Preservation Office.

3.6 NOISE

3.6.1 Introduction and Regulatory Background

3.6.1.1 Noise Measurement and Terminology

Noise is customarily measured in decibels (dB), units related to the apparent loudness of sound. An A-weighted decibel (dBA) represents sound frequencies that are normally heard by the human ear. On this scale, the normal range of human hearing extends from about 3 dBA to 140 dBA, with speech normally occurring between 60 and 65 dBA. A 10-dBA increase in the level of a continuous noise represents a perceived doubling of loudness, whereas a 3-dBA increase is just noticeable to most people.

Because environmental noise levels fluctuate over time, a time-averaged noise level in dBA is often used to characterize the acoustic environment at a given location. The average noise intensity over a given time is the energy equivalent noise level (L_{eq}). The day-night equivalent noise level (L_{dn}) is a 24-hour L_{eq} , which is derived by adding a 10 dBA "penalty" to noise levels measured between 10 P.M. and 7 A.M. The community noise equivalent level (CNEL) incorporates an additional 5 dBA penalty to sound levels measured between 7 P.M. and 10 P.M. These "penalties" account for the greater sensitivity of people to high noise levels at night. Table 3.6.1.1-1 shows the noise levels of different activities and the response criteria of various noise levels.

Table 3.6.1.1-1. Common Noise Levels and Human Response

<u>Sound Source</u>	<u>dBA</u>	<u>Response Criteria</u>
Within 200 feet of jet takeoff	130	Threshold of pain
Hard rock band	120	
Accelerating motorcycle	110	Deafening
Noisy urban street	90	
School cafeteria (untreated surfaces)	80	Very loud
Near freeway auto traffic	60	Loud
Average office	50	
Soft radio music in apartment	40	Moderate
Average residence without stereo playing	30	
Average whisper	20	Faint
Threshold of audibility	0	Very faint

Source: U.S. Department of Housing and Urban Development, *The Noise Guidebook*, 1985.

3.6.1.2 Noise Guidelines and Standards

Noise guidelines and standards have been developed by federal, state, and local agencies. The standards most applicable to the proposed project are the California Office of Noise Control standards and the noise element of each affected county's general plan. The Office of Noise Control guidelines, presented in Table 3.6.1.2-1, provide criteria for acceptability of noise levels for various land uses. Most of the

affected counties' noise standards or guidelines from their noise elements are based on or similar to the Office of Noise Control criteria.

Table 3.6.1.2-1. California Office of Noise Control Land Use Compatibility Guidelines

<i>Land Use Category</i>	NOISE EXPOSURE (dB)			
	<i>Clearly Unacceptable</i>	<i>Normally Unacceptable</i>	<i>Conditionally Acceptable</i>	<i>Normally Acceptable</i>
Residential -- low density	> 75	70-75	55-70	50-60
Residential -- multi-family	> 75	70-75	60-70	50-65
Transient lodging	> 80	70-80	60-70	50-65
Schools, libraries, churches, hospitals	> 80	70-80	60-70	50-70
Playgrounds, neighborhood parks	> 72.5	67.5-75	---	50-70
Golf courses, water recreation, cemeteries	> 80	70-80	---	50-75
Industrial, utilities, agriculture	---	75-85	70-80	50-75

Source: California Department of Health Services 1976.

3.6.2 Existing Noise Sources and Sensitive Receptors

Regional sources that contribute to the ambient noise levels include vehicular traffic, trains, ship traffic, and aircraft overflights. Industrial noise sources contribute to a steady background noise level within isolated areas. Land uses such as housing, religious, educational, convalescent, and medical facilities are more sensitive to noise than commercial and industrial uses. Hotels are not classified as sensitive receptors. Existing noise sources and human sensitive receptors near each alternative site are described in sections 3.6.3 and 3.6.4. Wildlife may also be considered to be noise-sensitive receptors. All issues pertaining to wildlife are addressed under the Biological Resources section of this document.

3.6.3 Oakland Harbor

The area around the Port of Oakland project area is predominantly industrial. Therefore, existing noise sources in this area include industrial facilities and aircraft overflights from the Alameda Naval Air Station, which is located on the south side of the harbor channel.

The nearest sensitive receptors to the proposed dredging area are residences approximately 1,400 feet north of the proposed Inner Harbor turning basin on Castro Street by 4th Street and on Martin Luther King Jr. Way by 5th Street. These nearest receptors are isolated homes surrounded by commercial and industrial land uses. The next closest sensitive receptors are the Portabello condominiums on Embarcadero Street approximately 1,500 feet east of the eastern limit of the proposed dredging area. The nearest residential neighborhoods (West Oakland) start approximately 3,600 feet north of the proposed dredging area of the Middle Harbor. The distance is even greater from the Outer Harbor. A large industrial area lies between this residential area and both the Middle Harbor and the Outer Harbor.

3.6.4 Disposal Site Options

3.6.4.1 Ocean Section 102

This site is located in the ocean approximately 49 nautical miles from the coast and 50 nautical miles from the Golden Gate Bridge. The existing noise environment is dominated by natural sources and passing ships, and the site is located a considerable distance from any noise sensitive receptors.

3.6.4.2 Alcatraz

This site is located in San Francisco Bay. Ambient noise levels result primarily from natural sources and maritime traffic. The nearest sensitive receptors would be any National Park residences on Alcatraz Island, approximately 2,500 feet northeast of the site. The nearest sensitive receptors in San Francisco would be about 4,500 feet south in the Fisherman's Wharf area.

3.6.4.3 Bay Farm Borrow Area

This site is located in San Francisco Bay. Ambient noise levels result primarily from natural sources, and the site is located well away from any noise sensitive receptors.

3.6.4.4 Leonard Ranch/Redwood Landfill

Leonard Ranch Rehandling Option

The areas to the north, east, and south of the disposal site are predominantly agricultural and open wetlands. The Southern Pacific Railroad tracks abut the southern border of the site and State Route (SR) 37 abuts the northern border of the site. Therefore, noise in the area is dominated by train and highway sources. Port Sonoma-Marin, a public marina, north of the proposed transfer station, is west of the disposal site; this along with Petaluma River boat traffic may contribute some boating noise to the area as well. The nearest residence is about 600 feet northwest of the northwestern border of the site. There are no other sensitive receptors within about 2,400 feet of the site.

Redwood Landfill

The current surrounding land use is zoned agricultural (A-60). There are some existing commercial uses near the landfill property that are scheduled for relocation in the near future. U.S. 101 lies approximately 3,000 feet west of the facility. The Southern Pacific Railroad line is located just before the U.S. 101 right-of-way. Noise sources in the area include traffic from U.S. 101, frontage and access road traffic, aircraft flyovers from Gness Field located within a mile south of the landfill, and on-site activities at the landfill. U.S. 101 is the predominant noise source.

The nearest sensitive receptor to the landfill is a single residence approximately 2-1/2 miles south of the landfill. The Bahia development, the nearest cluster of residences, is approximately 3-1/2 miles southeast of the landfill.

3.6.4.5 Sonoma Baylands

The area to the north, east, and south of the disposal site is predominantly agricultural land and open wetlands. Northwestern Pacific Railroad tracks abut the northern border of the site and SR 37 lies about 1,500 feet north of the site. Therefore, noise in the area is dominated by train and highway sources. Port Sonoma-Marin, a public marina, is southwest of the proposed disposal site and north of the proposed transfer station site; boats and jetskis in the marina and along the Petaluma River may also contribute noise to the area.

The nearest sensitive receptor to be considered with respect to noise is a single residence about 1,800 feet north of the northwestern portion of the site. Wildlife are not normally included within the definition of "sensitive receptor," however, some biological receptors could be considered sensitive to noise. Northern coastal salt marsh south of the perimeter levee provides habitat for wildlife that are considered sensitive biological receptors with respect to noise.

3.6.4.6 Galbraith Golf Course

The existing noise environment at the golf course is dominated by aircraft noise from the Metropolitan Oakland International Airport to the west and north of the site. Other noise sources include motor vehicle traffic and industrial and commercial activities from surrounding properties.

Noise contours developed for 1991 conditions at the airport indicated that the 65 dB CNEL contour falls on the western border of the site and crosses over the northern portion of the site (ESA 1991). The 70 dB CNEL contour appears to just touch a segment of the northern border of the site. Therefore, the existing noise levels at the golf course range from 60 to 70 dB CNEL. This is within the "loud" category designated on Table 3.6.1.2-1.

There are no residential areas or other sensitive receptors within 2,000 feet of the site, as industrial and airport land uses immediately surround it.

There are two pump-out options associated with the Galbraith disposal alternative. Option A prescribes the placement of the pipeline to within 2,000 feet of two areas of sensitive receptors: Lincoln Park and the residential area at the southeast portion of Alameda. There are no residential areas or other sensitive receptors within 2,000 feet of the Option B route.

3.6.4.7 Port/Landfill

The noise sources and sensitive receptors at the Ninth Avenue Marine Terminal would be essentially the same as those described for the Oakland Harbor area (see section 3.6.3).

3.6.4.8 Montezuma Wetlands

The noise sensitive land uses in the area are residences along Collinsville Road adjacent to the Sacramento River (Collinsville Resort). A Department of Water Resources day-use area is also located along Montezuma Slough at the end of Fire Truck Road. Short-term noise measurements taken recently for another analysis (Solano County 1993) indicate that the average noise level (L_{eq}) near the residential areas ranges from 41 to 44 dBA during the daytime. The background noise level (the noise level exceeded 90

1 percent of the time) ranged from 36 to 38 dBA. The primary noise sources at the site are birds, wind,
2 and distant air traffic associated with Travis Air Force Base. Noise levels generated by aircraft did not
3 exceed 48 dBA. The Jerico dredging operation is the major source of noise in the immediate project
4 area, but noise from this activity was not audible at either site at which noise measurements were taken.

3.7 SOCIOECONOMIC ENVIRONMENT

3.7.1 Regional

The regional maritime industry encompasses a 16-county region comprising Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties in the San Francisco Bay area; Placer, Sacramento, Sutter, Yolo, and Yuba counties in the Sacramento area; and San Joaquin and Stanislaus counties in the Stockton area.

The Ports of Oakland, San Francisco, Redwood City, and Richmond are located on San Francisco Bay, and the Sacramento and Stockton ports are located in the delta adjoining San Francisco Bay. The Bay Area region is the fourth largest metropolitan area in the United States, with a population of 7.5 million residents.

San Francisco Bay and its adjoining delta constitute one of the largest natural harbors in the world. The ports of the San Francisco Bay and its adjoining delta ports are a major center for foreign trade. The region's ports handled foreign trade valued at approximately \$34 billion in 1992 (U.S. Department of Commerce, Bureau of the Census). The Bay Area ports handle cargoes from local, regional, and national markets for export trade, and import shipments from many countries throughout the world.

3.7.2 Oakland Harbor

The Port of Oakland is the fourth largest of the West Coast ports in loaded container cargo volume, and the fifth largest port in the nation in terms of cargo handled. The Port has more than 550 acres of marine terminal facilities, 27 deepwater berths, and 30 container cranes. Thirty-two shipping lines call at the Port. The harbor area includes Army and Navy installations, plus railroad operations (Port of Oakland 1992).

In 1991, the Port generated about \$1.2 billion in business revenue, including customs revenue, from its maritime operations. The Port provided 6,700 direct jobs and 2,900 induced jobs, generating a total of \$429.6 million in personal income. Direct jobs are those jobs generated by business that are directly involved with the movement of goods through Port marine terminal facilities. Induced jobs are those generated by the spending of income by people who have direct jobs. State, County, and local taxes generated by maritime activity totalled \$38.3 million in 1991 (Port of Oakland 1992).

In 1991, the Port handled about 15.8 million revenue tons. The 1991 Terminal Activity Report shows 1,405 vessel calls and 550 shared vessel calls. Three hundred barges, primarily transporting bunker fuel, were served by the Port. Approximately 669,000 containers were handled; 33 percent of these were sent to or from the Port by rail (Port of Oakland 1992).

3.7.3 Disposal Site Options

3.7.3.1 Ocean Section 102

Socioeconomic resources in the vicinity of this site include commercial and recreational fisheries and shipping. The proposed site has comparatively few fisheries resources. The primary recreational

fisheries in this area are for pelagic species, such as certain rockfishes, salmon, and tunas (EPA 1993). Ships from the six publicly used ports, 11 military installations, and several proprietary installations use the 11 navigable waterways in the San Francisco Bay and Delta. It is estimated that \$5.4 billion of economic activity is directly dependent upon deep and shallow draft navigation channels in the San Francisco Bay and Delta regions (Ogden Beeman 1990, cited in EPA 1993). Commercial shipping supports up to 35,000 full-time jobs, exclusive of jobs supported by Navy activities (EPA 1993).

3.7.3.2 Alcatraz

Socioeconomic resources in the vicinity of this site include commercial and recreational fisheries and shipping. The discussion regarding shipping in section 3.7.3.1 applies to this site, as well. Herring are the primary commercial fish species in the Central Bay. Other species of historic commercial importance include shark, perch, Jack smelt, shrimp, and crab. Striped bass have been the primary sport fishing species in the Central Bay. Other sport fishing species include sturgeon, perch, flounder, shark, rockfish, and halibut (COE 1992).

Although commercial and sport fishing remains a multi-million dollar industry in the Bay Area, some fishing interests believe there has been a decline in fish harvests and revenues (COE 1988). Examination of causes in the fishery decline have been undergoing scientific scrutiny for several years. The following combination of major factors have been closely associated with the decline in the Bay fisheries: (1) large water diversions in the Sacramento River and San Joaquin River Delta area; (2) loss of upstream riverine spawning habitat; (3) meteorological changes; (4) exploitation of the fishery resource; (5) substantial predation; and (6) environmental contamination (COE 1992a).

3.7.3.3 Bay Farm Borrow Area

Socioeconomic resources in the vicinity of this site include commercial and recreational fisheries and shipping. The discussion regarding shipping in section 3.7.3.1 applies to this site, as well. Adult Pacific herring support an important commercial fishery in San Francisco Bay. Although they are only fished for a few months, the value of the herring catch is \$10-15 million annually (COE 1988, cited in PTI 1989). Herring are known to spawn in the eelgrass beds of the Borrow Area (Dr. Chris Kidding, UC Hayward) and they also migrate through this area. The white sturgeon is not harvested commercially, but is a popular sportfish. Its feeding grounds are found in the vicinity of the Bay Farm site. Striped bass, a commercially important fish, also use this area as a feeding ground. The discussion in section 3.7.3.2 regarding decline in fishing opportunities applies to this site, as well.

3.7.3.4 Leonard Ranch/Redwood Landfill

Leonard Ranch Rehandling Option

Oat hay is the only crop that has been grown at the site in recent years. The crop ranks 14th in terms of farm crop revenues in Sonoma County (SCOAC 1991). In 1991, 15,843 acres of hay were harvested in the County. The oat hay yield was 40,256 tons, averaging 2.5 tons per acre. Based on this average, the Leonard Ranch rehandling site produced an estimated 575 tons of oat hay.

The former Leonard Ranch property was placed under a Williamson Act contract in 1992. Under current laws, lands under contract are appraised for their agricultural productivity rather than their market value.

Agricultural Preserve lands are to be retained in agriculture or open space use for at least 10 years, with an automatic renewal clause.

3.7.3.5 Sonoma Baylands

Oat hay is the only crop that has been grown at the site in recent years. The crop ranks 14th in terms of farm crop revenues in Sonoma County (SCOAC 1991). In 1991, 15,843 acres of hay were harvested in the County. The oat hay yield was 40,256 tons, averaging 2.5 tons per acre. Based on this average, the Sonoma Baylands site produced about 800 tons of oat hay.

The former Leonard Ranch property was placed under an Agricultural Preserve (Williamson Act) contract in 1992. Under current law, lands under contract are appraised for their agricultural productivity rather than their market value. Agricultural Preserve lands are to be retained in agricultural or open space uses for at least 10 years, with an automatic renewal clause. Ultimately, the former Sonoma Baylands property is expected to be transferred to the California Department of Fish and Game for long-term management.

3.7.3.6 Galbraith Golf Course

Galbraith Golf Course includes an 18-hole golf course, driving range, and clubhouse restaurant. A soccer field is located between the 18th fairway and Doolittle Drive. On a yearly basis, about 65,000 rounds of golf are played, and about 15,000 patrons use the driving range. The City of Oakland leases the site from the Port of Oakland. The City's golf course concessionaire, Ransom McKay Golf, Inc., is operating under an expired 90-day interim concession agreement with the City of Oakland. The golf course employs 25 full-time and part-time people during the regular season, with an additional 5 full-time and part-time employees hired in the summer months. The concessionaire owes the City over \$300,000 in unpaid contract obligations.

East Bay Municipal Utility District, the City of Oakland, and Ransom-McKay Golf, Inc., currently have a long-term agreement stipulating that a minimum amount of reclaimed water be used at the golf course. The current rate is \$0.77 per hundred cubic feet. The golf course uses about 200 acre-feet of reclaimed water per year. Peak demand during the summer months reaches about 1/2 million gallons per day. No irrigation is necessary during the winter months.

3.7.3.7 Port/Landfill

The Ninth Avenue Terminal is leased by the Port of Oakland to Marine Terminals Corporation which provides breakbulk, steel and limited container services to five shipping lines. The facility was formerly open five days a week for consignee pickup of shipments ordered, but currently is open three days. Increased U.S. tariffs have reduced steel imports substantially, and the breakbulk import business has declined in the last few years. Marine Terminals Corporation has been the tenant for more than 20 years; the current lease expires in September 1994. Harbor Forklift subleases a small area of the site. In 1992, marine terminal operations at the Ninth Avenue Terminal generated \$500,000 in minimum guaranteed revenues to the Port. The 9.2-acre site proposed for the temporary rehandling of material to be confined is currently used for the receiving, sorting, and short-term storage of steel pipe awaiting pickup by consignees. Marine Terminals Corporation has four permanent employees on the site. Harbor Forklift has three permanent employees. Temporary on-site employment varies widely depending on operational

needs, with workers drawn from the Pacific Maritime Association Union Hall on an as-needed basis (Cathey 1993).

3.7.3.8 Montezuma Wetlands

Solano County's fiscal problems have been well documented by two recent reports: Recht-Hausrath & Associates' *The Cost of Growth* (1991) closely analyzes the county's ability to deliver services, while the Solano County Private Industry Council's *Strategic Plan for Solano County Economic Development* (1992) builds on *The Cost of Growth* to discuss options for improving the county's fiscal health. This section draws from both of these reports.

At the end of the 1987-88 fiscal year, Solano County ran a general fund deficit. As a result, the county is in the midst of a five-year financial plan that incorporates severe budget cuts, wage control, and one-time revenue sources to balance the general fund (Recht-Hausrath 1991). Paramount among the county's problems is the fact that throughout the latter 1980s, it has ranked among those counties that exceeded the statewide average of 55 percent of general purpose revenues as an expenditure for state-mandated programs. From the 1984-85 fiscal year to 1987-88, Solano County led all counties in percentage increase in share of general purpose revenue devoted to such programs (Solano County 1992).

While the county continues to experience a stagnating revenue base in the face of increasing county-wide costs brought about by growth in its cities, its ability to increase its revenue base is limited by Proposition A. In simplified terms, Proposition A limits the county's ability to re-zone unincorporated land and directs growth to cities, which are able to annex the land and pursue development. The new development places an additional burden on the county's ability to provide county-wide services (Solano County 1992).

The Montezuma Hills area, which includes the project site, is one of the county's long-term prospects for revenue enhancement through development, as it is already zoned for industrial development. The Montezuma Wetlands Project proposes to use a portion of this county asset for dredge material disposal and subsequent wetlands reclamation.

3.8 TRANSPORTATION AND CIRCULATION

3.8.1 Oakland Harbor

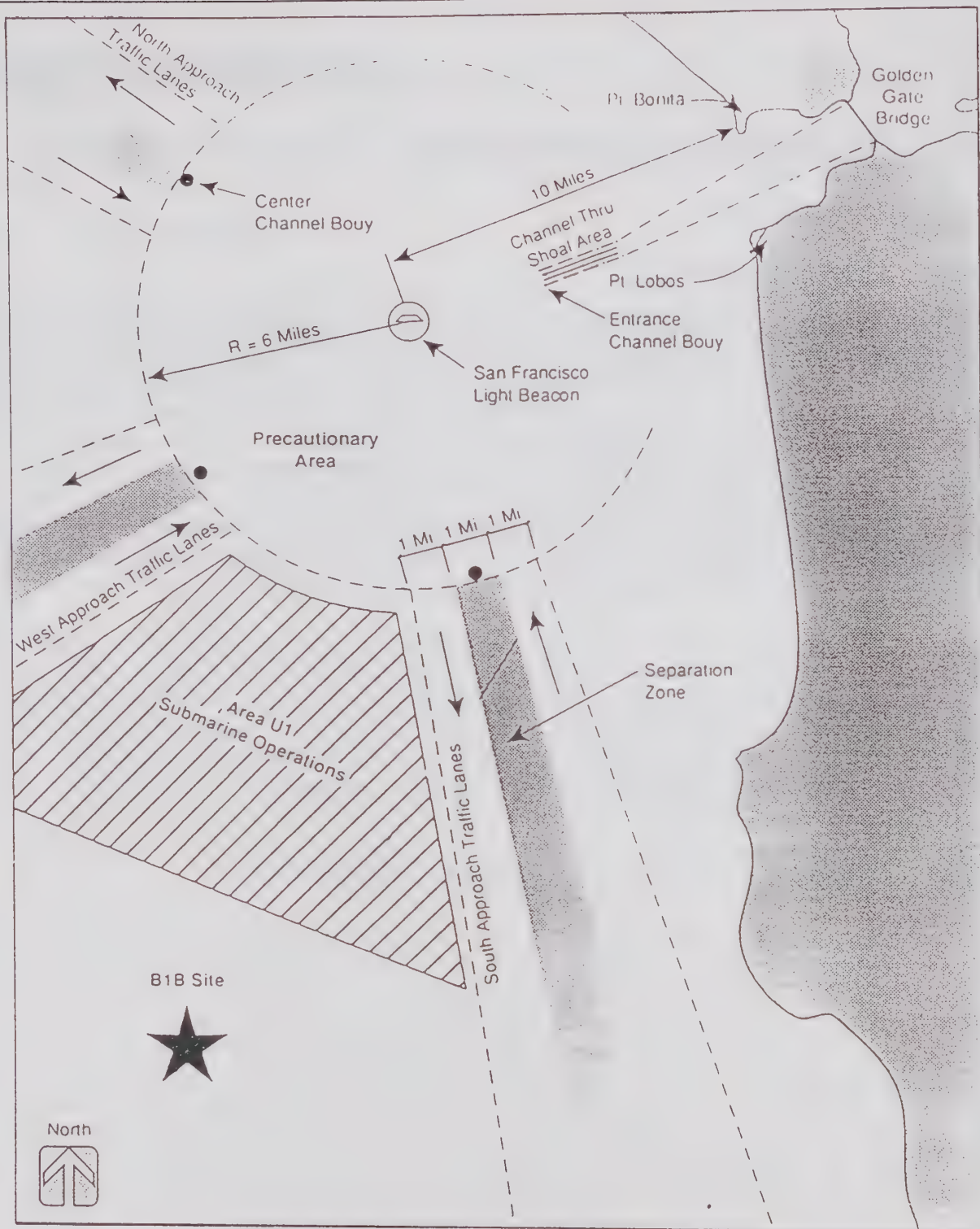
3.8.1.1 Vessel Transportation

The Ports and Waterways Safety Act of 1972 set up rules for entering and leaving ports and established traffic lanes for inbound and outbound vessel traffic and specified the separation zones between them. West of the Golden Gate Bridge there are approach channels from the north, west and south (Figure 3.8.1.1-1). Each approach lane from seaward is composed of a mile-wide inbound traffic lane and a mile-wide outbound traffic lane separated by a mile-wide separation zone. There are areas outside these lanes designated for submarine operations wherein the U.S. Navy precludes barge operations. The approach lanes lead to a large offshore light station with a rotating beacon that marks the beginning of the main channel to the Golden Gate Bridge. The beacon, which is located approximately 10 miles west of Point Bonita, is in the center of a large precautionary area where all ships leaving and entering port converge. It is an area where many ships take on or discharge bar pilots.

From the rotating beacon, ships traveling to the Port of Oakland proceed in an easterly direction toward the Golden Gate through a narrow channel which is again composed of inbound and outbound traffic lanes with a separation zone between them. These traffic lanes are 600 yards wide with the separation zone approximately 150 yards wide. The channel is marked on either side with a series of buoys through a shoal area, approximately half-way between the rotating beacon and a line drawn from Point Bonita to Point Lobos. The water is usually more than 90 feet deep throughout this area, with the exception of shoal areas, which are maintained at a depth of 50 feet. Shoal waters less than 30 feet deep exist on either side of this narrow channel. Standard aids to navigation such as horns, bells and lights are provided at appropriate locations near submerged rocks and points of land.

East of the Golden Gate Bridge (Figure 3.8.1.1-2), the traffic lanes continue with the separation zone between east and westbound traffic being located on a line from center of the Golden Gate Bridge to Alcatraz Island. All eastbound traffic, even if bound for Richmond and points north, should pass to the south of Alcatraz Island. Westbound traffic should pass to the north of the Island. These channels and separations are not currently mandatory and enforced by the Vessel Traffic Service (VTS), so there is some unauthorized deviation to this route; however, the VTS is about to install mandates/compliance rules that would stop this practice. There is a precautionary area immediately east of Alcatraz Island where the channel from the southern bay meets that coming from the northern bay. This area is comparatively small, being only slightly larger than one mile in diameter. It is an area of relatively high congestion in that it is the confluence of several channels of traffic moving in opposing directions. The southerly traffic lanes continue along the San Francisco city front from the Blossom Rock light to the San Francisco-Oakland Bay Bridge, with the separation zone extending along a line from the center anchorage of the Bay Bridge to Blossom Rock. Inbound traffic must pass southwest of the center anchorage of the Bay Bridge with outbound traffic passing northeast of the center anchorage.

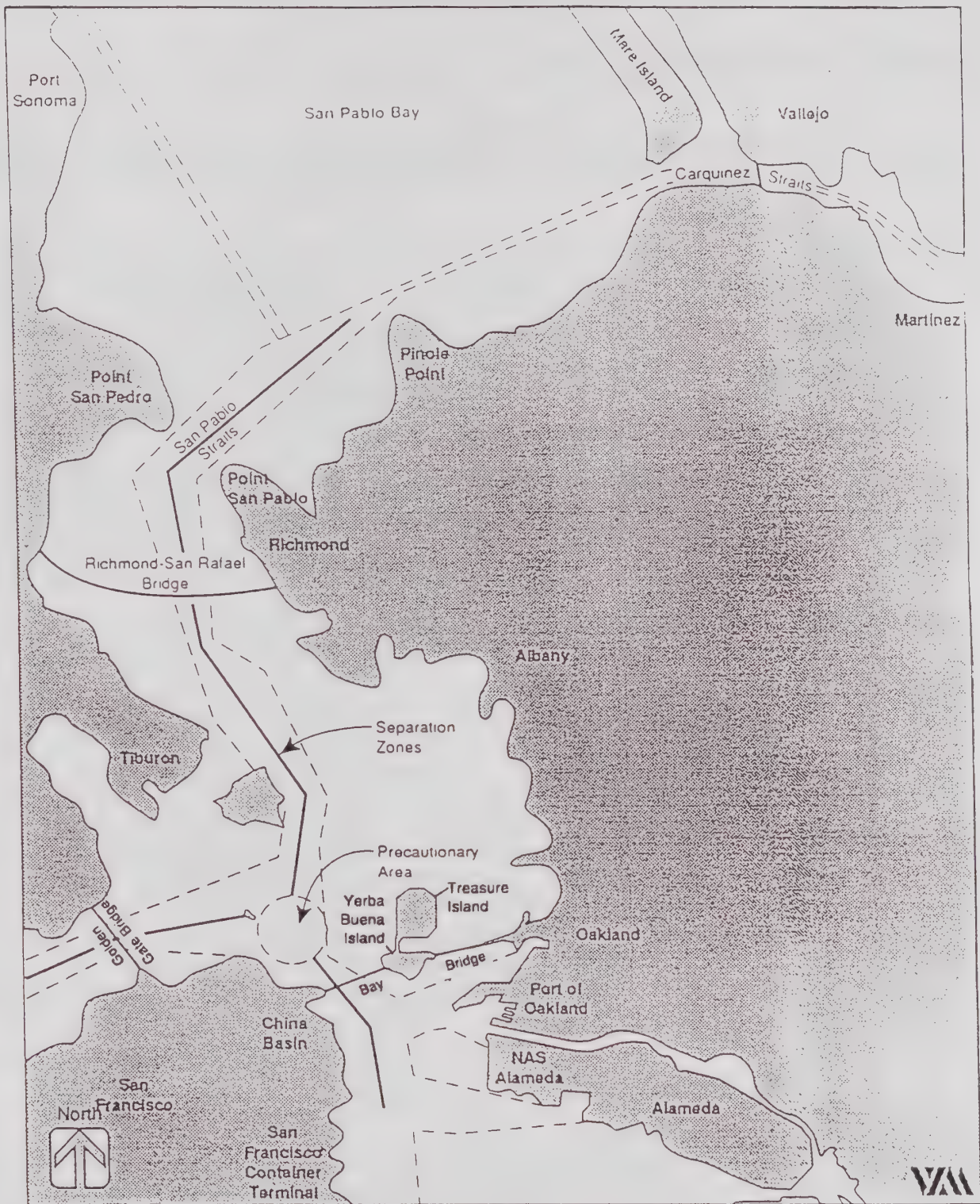
South of the Bay Bridge (Figure 3.8.1.1-2), traffic lanes diverge in several directions. Ships destined for Oakland and Alameda turn left and cross the north-bound traffic lane, while ships bound for Hunter's Point and the San Francisco southern waterfront continue in the southerly direction. The east side of



NOT TO SCALE

Figure 3.8.1.1-1

APPROACH LANES AND SEPARATION ZONES IN THE GULF OF THE FARALLONES



NOT TO SCALE

Figure 3.8.1.1-2

MARKED CHANNELS AND SEPARATION ZONES IN THE CENTRAL SAN FRANCISCO BAY

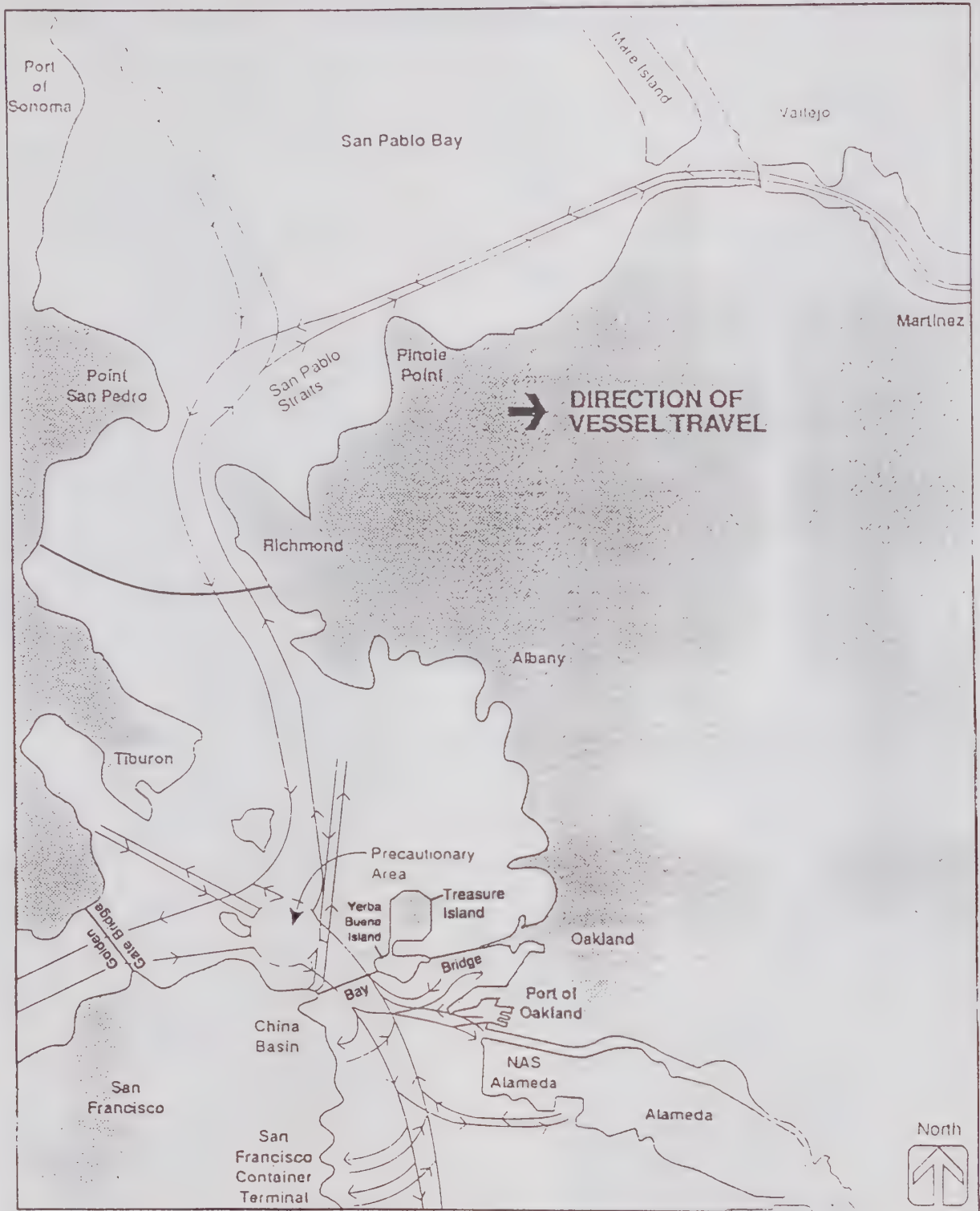


Figure 3.8.1.1-3

TYPICAL VESSEL TRAFFIC ROUTES IN THE SAN FRANCISCO BAY

southern San Francisco Bay from central Alameda to the San Mateo Bridge is a general anchorage area. Within this area, there are two explosive anchorage areas with forbidden anchorage zones surrounding them.

South of Yerba Buena Island, the Oakland Bar Channel is the entrance to the Port of Oakland's Inner Harbor, Middle Harbor, and Outer Harbor. It is designated as a limited traffic area. This area is supposed to have only one way traffic, either inbound or outbound at one time.

The Coast Guard's VTS Center, which is located on Yerba Buena Island, controls marine traffic throughout the Bay Area and closely monitors this limited traffic area because of the large number of ships using the Oakland terminals and the small amount of space available for maneuvering.

Inbound ships destined for Naval Air Station, Alameda do not use the Oakland Bar Channel. Rather they proceed to a point about a mile south of the Bay Bridge before turning left and entering the approach channel to the air station. This channel is 350 yards wide and is maintained by the U.S. Navy at a depth sufficient for its largest aircraft carriers.

Traffic to the San Leandro area continues about 10 miles to the south before turning east. Mud flats extend about 2 miles offshore of the San Leandro shoreline.

Ships inbound for Point Molate, Mare Island Naval Shipyard, or other ports along the way to Sacramento or Stockton turn left after reaching the precautionary area east of Alcatraz (Figures 3.8.1.1-2 and 3.8.1.1-3). They proceed in the northbound traffic lane toward the San Rafael Bridge. These traffic lanes vary in width from 500 to 1,100 yards and have a 150-yard separation area between them. The channel narrows under the San Rafael Bridge and then opens to nearly 1,500 yards beyond the San Pablo Straits. Adjacent to Pinole Point, the channel reduces to a 600-foot width and continues at that width with no separation of opposing traffic lanes through the Carquinez Straits.

The Sacramento and San Joaquin River from the Carquinez Straits to the Twitchell Island site have reaches of deep navigable water. Naturally shallower reaches of the rivers have dredged channels that are marked with buoys on both sides.

3.8.1.2 Ground Transportation

Regional Highway System

Figure 3.8.1.2-1 shows a regional map of transportation facilities. The Port is located near the hub of the Bay Area freeway system. A description of the system is provided in Table 3.8.1.2-1 below. There are three major entrances to the Port: Maritime Street, Middle Harbor Road, and 7th Street. The West Grand Avenue structure provides a connection from the Port and downtown Oakland to Interstates 80 and 580. It is an elevated structure from Mandela Parkway to the Bay Bridge toll plaza, with ramps provided at Maritime Street.

Improvements are currently planned for several nearby freeways as described below.

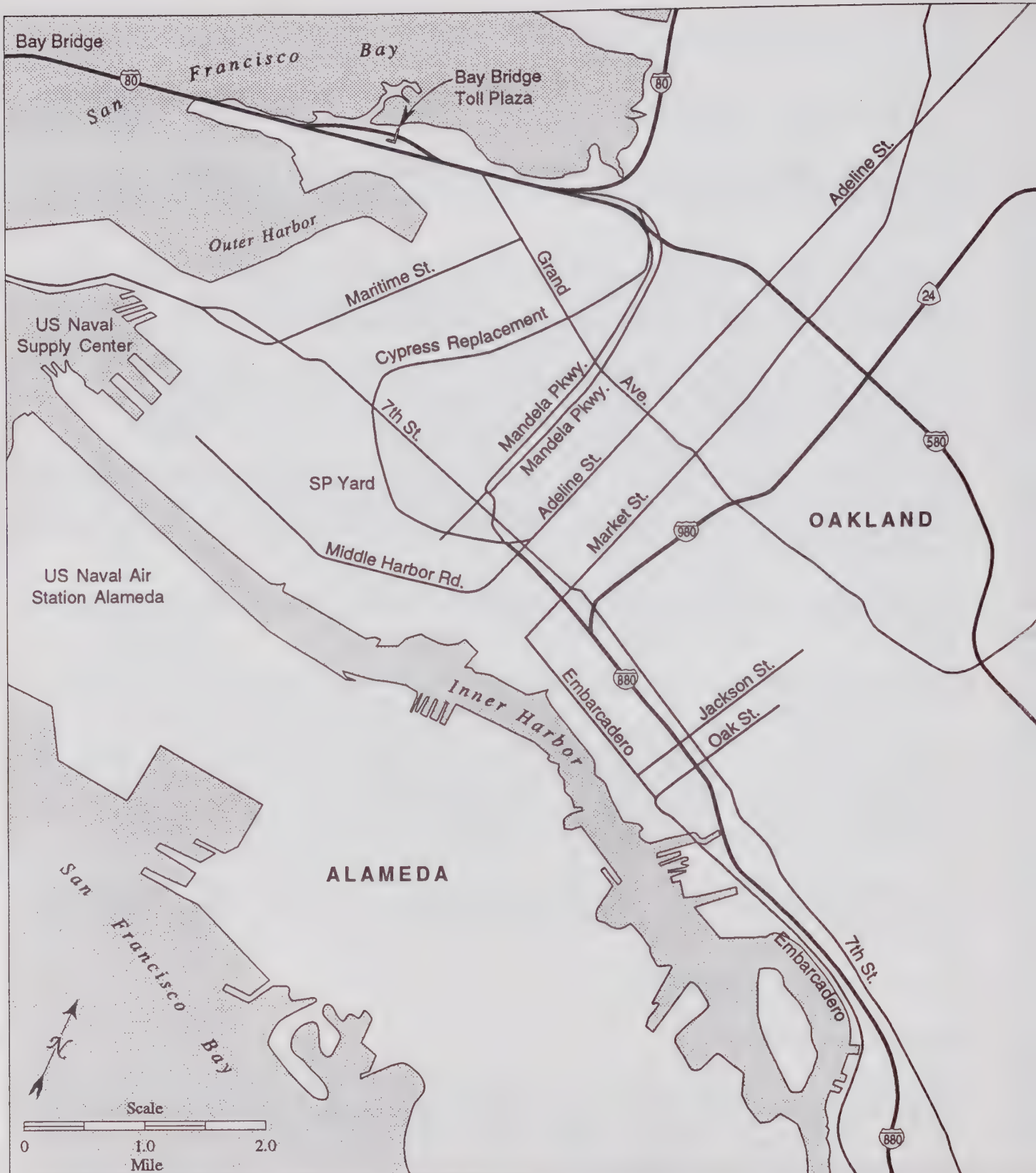


Figure 3.8.1.2-1
REGIONAL HIGHWAY MAP

Table 3.8.1.2-1. Regional (Freeway) Highway Facilities

<u>Route</u>	<u>Number of Lanes (total)</u>	<u>Ramps/Interchanges Nearest Port of Oakland</u>	<u>Destinations Served</u>
SR-24	6-8	No ramps directly serving.	Central Contra Costa County; Solano County and points east (joins I-80).
I-80	8-10	West Grand Avenue interchange; connections to Mandela Parkway (formerly Cypress Street).	San Francisco/West Bay, West Contra Costa County, Sacramento and points north & east.
I-580	8	West Grand Avenue/80 ramps.	Northern Alameda County, Livermore-Pleasanton, Stockton, and I-5 corridor south.
I-880	8	Mandela Parkway/7th Street interchange, Market Street ramps, Oak/Jackson Street ramps.	West (industrial) Alameda County, Southbay and southern Peninsula, San Jose.
I-980	6-10	12th Street ramps.	Downtown and West Oakland.

I-80: Widening with a commuter (carpooling with a minimum of 2 people per vehicle) lane from Route 4 (Pinole) will occur in a phased construction program over the next 4 years. One phase includes reconfiguration of the I-80/I-580 (Albany) interchange, where the existing left exit going toward Richmond will be replaced with a safer right-hand exit. A second phase will provide direct access to Cutting Boulevard from the commuter lane. The third phase is an elevated ramp to beyond Bay Bridge Toll Plaza for commuter lanes. The expected date of completion is late 1996.

I-580: Widen in the eastbound direction between I-80 and I-980 (completed, May 1993). Modify the existing distribution structure as part of Cypress Structure replacement project.

I-880: Replace Cypress Structure (collapsed during the Loma Prieta earthquake) from about one mile northwest of I-980 to the I-80/I-580/I-880 distribution structure. New alignment will follow SPTC tracks westerly of old structure, and will be a six-lane freeway, partly elevated and partly at-grade. A connection to/from the Bay Bridge will be provided at West Grand Avenue connector, as well as ramps to and from I-80 east.

A full (i.e., all direction) split-diamond interchange will be provided at Adeline/Union streets, for access to and from the Port and downtown. Access will also be provided at 7th Street and West Grand Avenue, which are to be connected by a frontage road. The replacement structure will split north of 7th Street with one connector providing access to the Bay Bridge and the other heading toward Berkeley. The Cypress project will begin in January 1994 and should be completed by the end of 1997. The planned alignment is shown in Figure 3.8.1.2-1.

City Streets and Other Roads

MARITIME STREET is a four-lane arterial with a center, two-way left-turn lane. It is heavily used by trucks (and other traffic) accessing the Outer Harbor container terminal and the Oakland Army Base, among other uses. It provides the primary access to I-80 and I-580 from the Port.

7TH STREET carries all traffic into and from the 7th Street Marine Complex, and provides the primary access route to I-880 (existing ramps at Adeline and Mandela Parkway). 7th Street is four lanes wide (two lanes in each direction). In some areas it is divided with left-turn pockets. The outer (westerly) portion of the roadway is presently being reconstructed.

MIDDLE HARBOR ROAD is a continuation of Adeline Street serving the Port, the Naval Supply Center, and the Southern Pacific Railroad. From Third Street to the American President Lines terminal, it is four lanes. Its mid-section is a narrow two-lane road, and it becomes four lanes again somewhat south of 7th Street. There are plans to improve the west end of this road, from Adeline Street to the 7th Street/7th Street Extension intersection. This will involve widening the two-lane section to a four-lane road with a 16-foot median left-turn lane. Anticipated completion is August 1994.

MANDELA PARKWAY is a four-lane divided roadway that was formerly the route of the I-880 Cypress Structure. It primarily serves as a local access route for industrial uses in the West Oakland area, although it also carries some local traffic to and from I-80. Truck through traffic is discouraged.

THE EMBARCADERO is a two-lane road with rail tracks in the center for 6 blocks of its length. The two-lane haul road along the Embarcadero was recently extended from Martin Luther King Jr. Way to Adeline Street.

Railroad Facilities

The Port is served by three railroad companies: the Southern Pacific Transportation Company (SPTC), the Atchison, Topeka, and Santa Fe Railway (Santa Fe), and the Union Pacific (UP). All three railroads are Class I railroads with national route systems. The SPTC serves the Port by both a southern and a central route. Its network goes from New Orleans across the southern and central tier of states as far north as Portland, Oregon. The Santa Fe covers the central tier of states from Chicago west. The UP also covers the mid-section of the continent, including southern California, and has major interchange points with other railroads in Omaha and St. Louis. The Santa Fe also provides service to the Gulf/Southeast.

All three railroads have Bay Area intermodal yards. The SPTC has the largest yard facilities within the Oakland Harbor area (as shown on Figure 3.8.1.2-1). The UP has a long, narrow combination intermodal and classification/storage yard, as well as automobile terminal, located in the Harbor area. The UP yard is located southwest of the Naval Supply Center, directly adjacent the Port's marine terminals. The Santa Fe's principal intermodal yards are located in west Richmond, near the Richmond-San Rafael Bridge. The Santa Fe has a small yard serving the Port of Oakland, located north of West Grand Avenue near the Bay Bridge distribution structure, and uses trackage rights over the SPTC to its Richmond intermodal facilities.

The UP and SPTC have begun to consolidate on the SPTC line along the Embarcadero. The consolidation removes the at-grade crossings on Third Street as well as speeds up movement in and out of both rail yards by removing the conflict near Adeline Street, where the UP tracks cross the SPTC tracks.

Improvements will be made to the SPTC tracks to allow for the consolidation and accommodate a new Amtrak Oakland station. A two-year timeframe is estimated for the consolidation effort (i.e., spring of 1995 (personal communication, J. Putz 1993).

Existing Traffic Volumes

The State Department of Transportation (Caltrans) estimated annual average daily traffic volumes (AADT) for 1991 are shown in Figure 3.8.1.2-2 (Caltrans 1992), along with weekday traffic volumes on key surface streets.

PEAK PERIOD CHARACTERISTICS OF TRAFFIC. Peak period traffic volumes (1991) were obtained from available Caltrans data, and from traffic counts done specifically for this SEIR/EIS in January-February 1993 at the three key entrances to the Port:

1. Maritime Street, south of the West Grand Avenue ramps
2. 7th Street, southeast of the 7th Street Extension
3. Middle Harbor Road, west of 3rd Street (on highway bridge over SPTC yard)

These data were used to assess the existing peaking characteristics of traffic. A graphic portrayal of the results of the hourly traffic counts at these locations is shown in Figures 3.8.1.2-3 through 3.8.1.2-5 on the following pages. All three traffic counts show an unusual pattern (compared to typical city streets) of three peak periods during the day, 6 to 7 A.M., 11 A.M. to 12 P.M., and 3 to 4 P.M. The "inbound" direction on the figures refers to the direction travelling toward the Port, and "outbound" to trips travelling from the Port terminals to nearby freeways.

Recurring congestion (i.e., not related to accidents or other "incidents") occurs in the following areas for the reasons stated:

- A.M. Peak: Bottlenecks occur on I-80 westbound in the A.M. peak at two locations: demand exceeds capacity at the diverge of I-80 and I-580 (distribution structure), and at the foot of the Bay Bridge, where the nine lanes that feed the Bay Bridge narrow to five on the Bridge structure. On I-580, slowing occurs regularly in both directions between I-80 and I-980 due to the re-routing of all traffic from the collapsed Cypress structure (in the westbound direction, it is mostly the outer lanes headed for I-80 eastbound that are affected). I-980 is also congested for most of its short length (generally southbound from the 12th Street off-ramps to I-580). SR 24 is generally not congested on a regular basis in this area, although traffic will sometimes backup from I-580 onto SR 24. Conditions on surface streets are generally within acceptable operating conditions, although volumes are high.

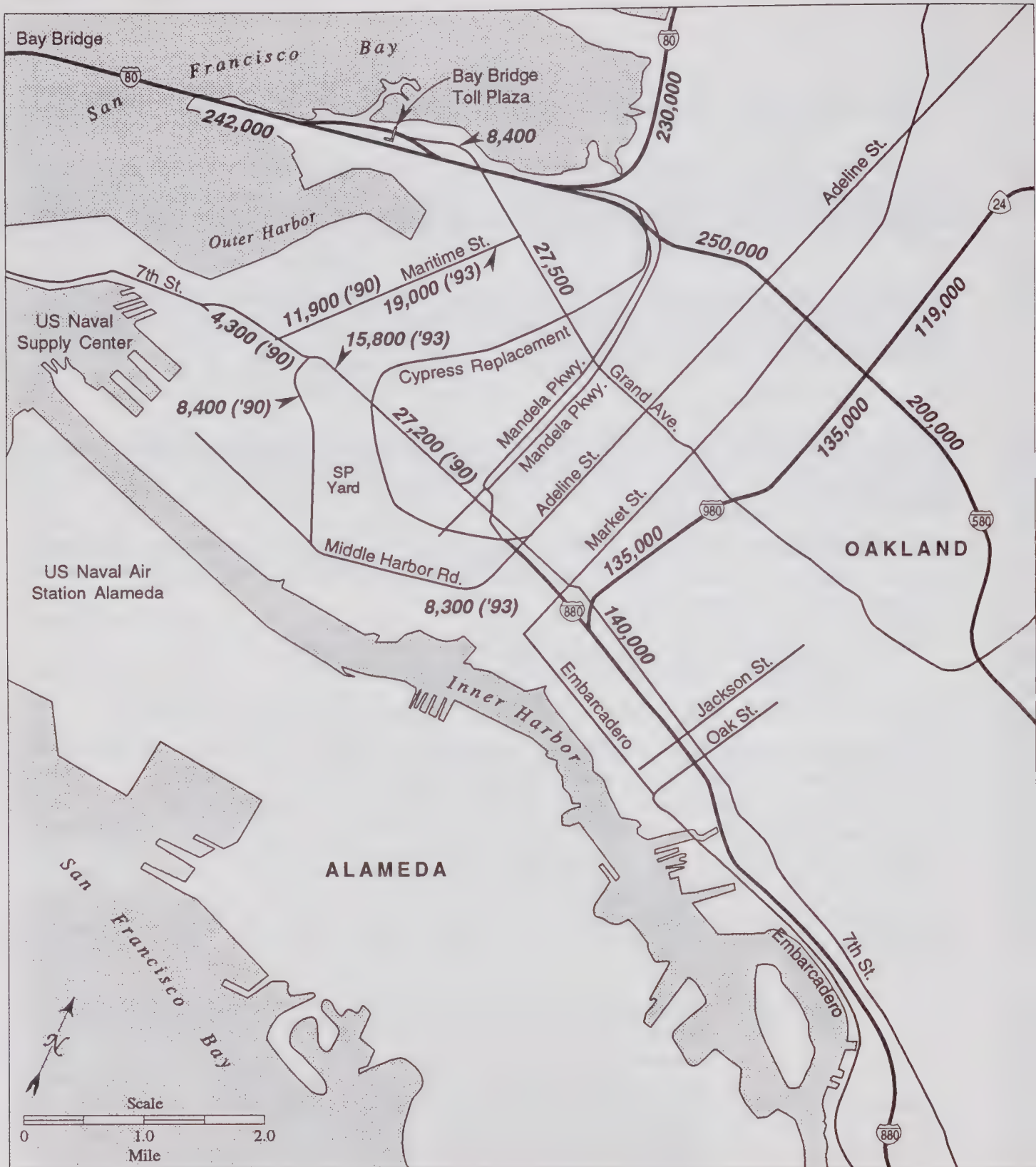
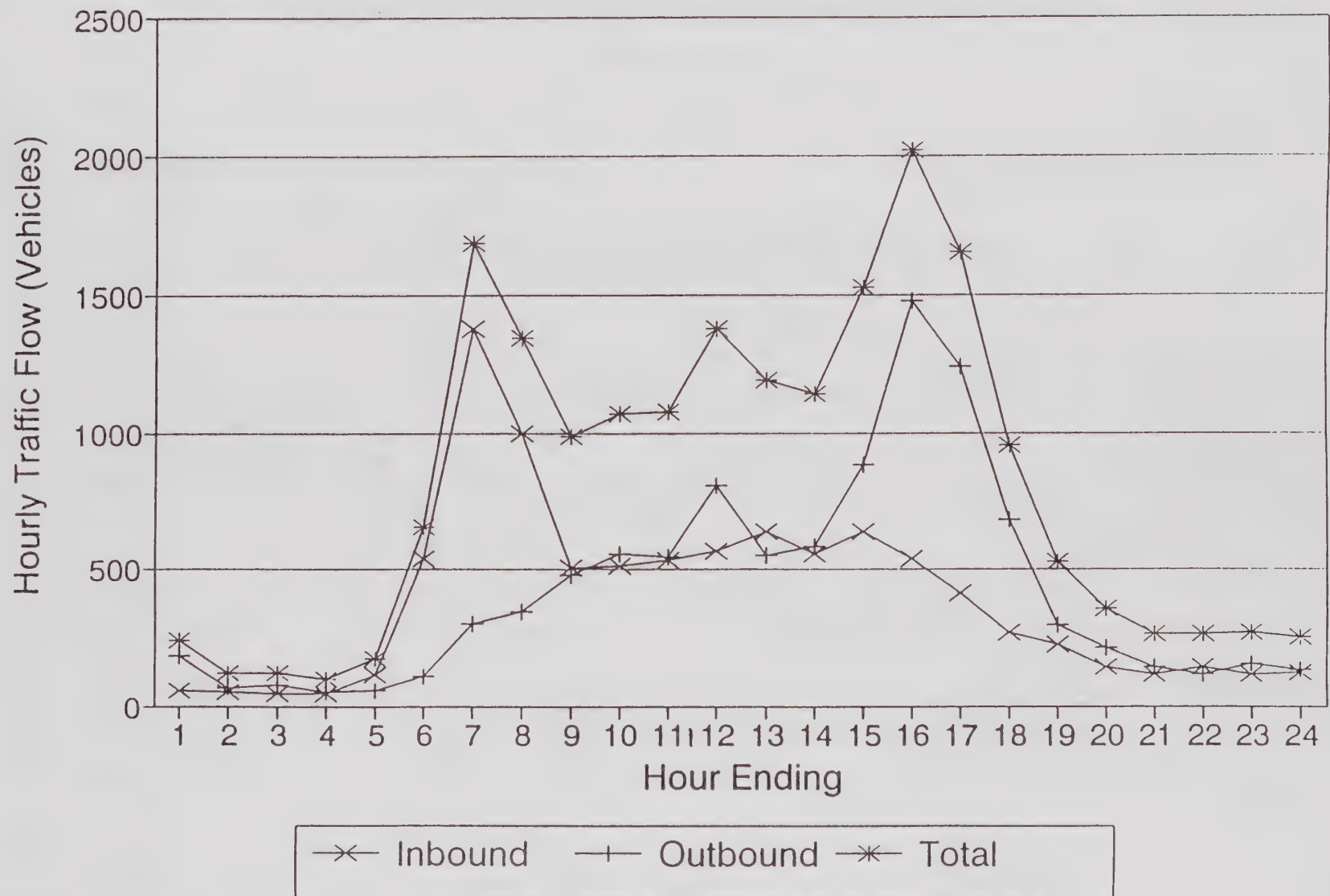


Figure 3.8.1.2-2

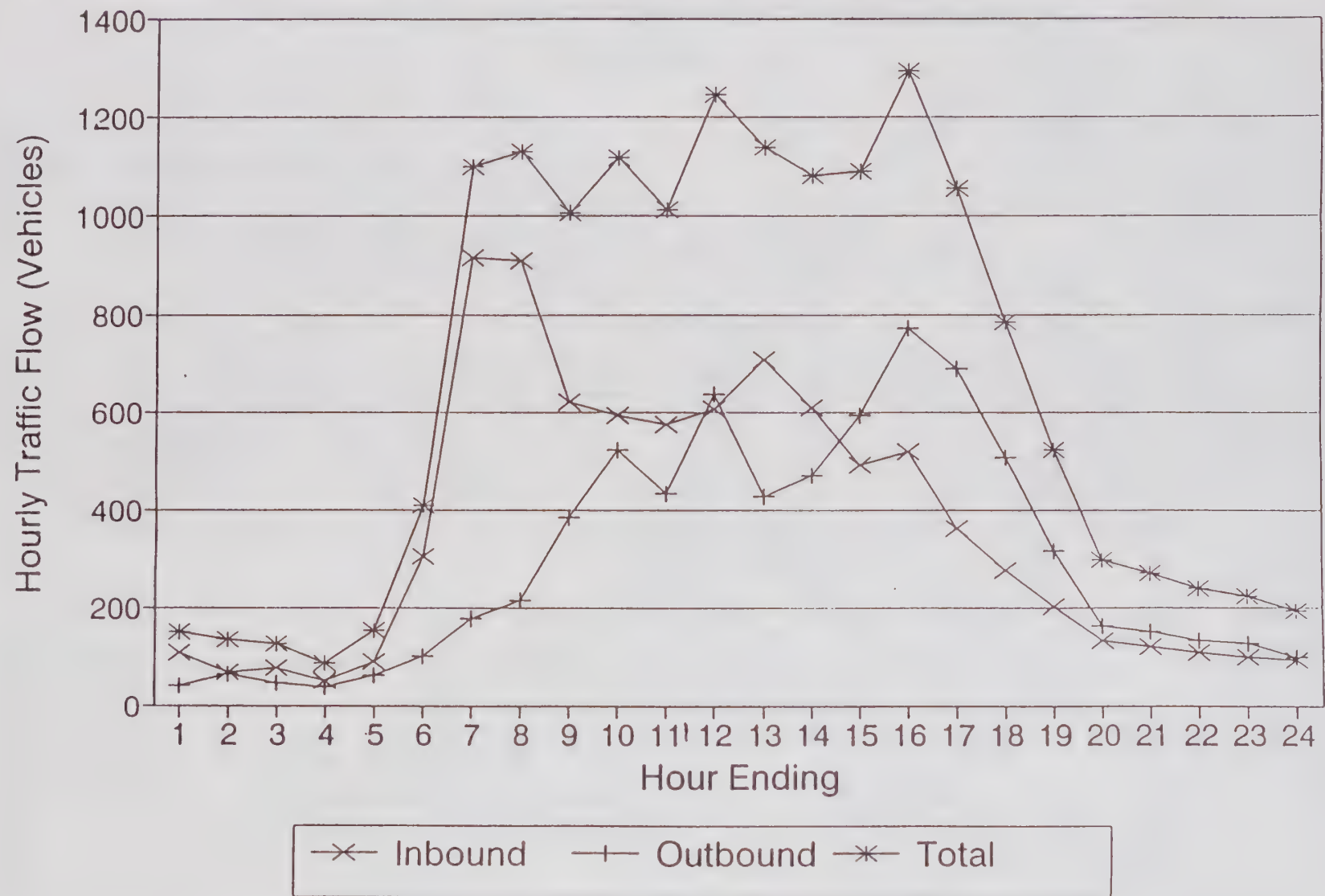
EXISTING DAILY TRAFFIC VOLUMES NEAR OAKLAND HARBOR (1991 UNLESS NOTED)



Source : Dowling Associates, January 1993.

Figure 3.8.1.2-3

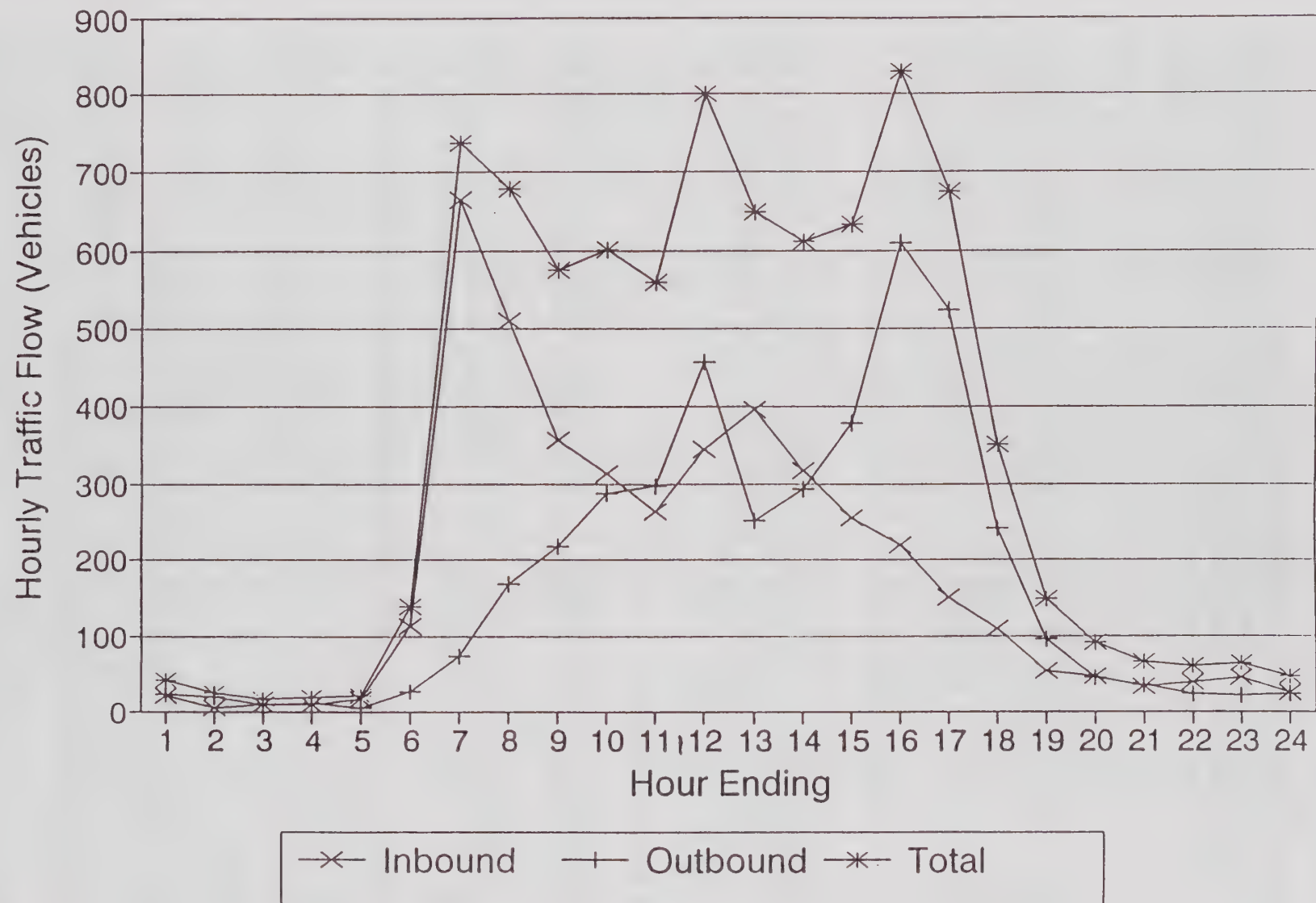
MARITIME STREET SOUTH OF GRAND AVENUE, HOURLY TRAFFIC FLOW



Source : Dowling Associates, January 1993.

Figure 3.8.1.2-4

7th STREET SOUTH OF 7th STREET EXTENSION, HOURLY TRAFFIC FLOW



Source : Dowling Associates, January 1993.

Figure 3.8.1.2-5

MIDDLE HARBOR ROAD SOUTH OF 3rd STREET AT BRIDGE, HOURLY TRAFFIC FLOW

P.M. Peak: Congestion occurs in both directions on I-80 from the distribution structure to Albany, and sometimes beyond. Moderate westbound delay occurs at peak times at the Bridge toll plaza, and sometimes backups reach the Oakland Army Base overcrossing. I-80 is sometimes congested in the eastbound direction of travel approaching the distribution structure. The most severe congestion on I-580 in the P.M. peak is in the westbound direction, between the ramp to I-80 eastbound and the SR 24/I-980 interchange. SR 24 is congested in the eastbound direction because the Caldecott Tunnels are a bottleneck. Although some slowing occurs, I-880 is generally not severely congested in the area within the Oakland City limits; the main problem areas are from Hegenberger to Washington (in San Leandro), and in Hayward (especially Washington to A Street, and Tennyson to Lewelling) (Alameda County Congestion Management Agency 1993). I-980 congestion occurs due to a bottleneck at the SR 24/I-580 interchange and can back up in the northbound direction for much of I-980's length.

Where feasible, trucking firms often schedule their work in the early morning and mid-day hours in order to avoid congestion in the above areas. The percentage of trucks in the P.M. peak (4 to 6 P.M.) traffic is generally less than that found during other hours of the day. Congestion affects trucks as well as other traffic, perhaps even more so, since it has a direct monetary cost (in wages, delivery delays, and direct vehicle operating costs) to trucking firms.

Existing Midblock Level of Service (LOS)

LOS is a qualitative measure of the performance of a midblock during some peak period (usually one hour). There are six letter levels of service, from A (best) to F (poorest). These are defined as follows:

LOS A describes primarily free-flow traffic operations at average travel speeds usually at least 90 percent of the free-flow speeds. For example, for a street where the posted speed and free-flow (uncongested) speed is 30 mph, speeds would generally be at least 27 mph.

LOS B represents reasonably unimpeded operations at average travel speeds usually at least 70 percent of the free-flow speed.

LOS C represents stable traffic operations, but the ability to maneuver and change lanes is more restrictive than LOS B. Average travel speeds are generally at least 50 percent of free-flow speeds.

LOS D borders on a range in which small increases in traffic may cause substantial increases in delay. Speeds are generally at least 40 percent of the free-flow speed.

LOS E and F are characterized by significant delays, long waits at signals and stop signs, and average speeds less than 40 percent of the free-flow speed.

During the morning peak hour of traffic, Maritime Street, south of the West Grand Avenue ramps, operates at LOS B (inbound) and LOS A (outbound). Seventh Street, southeast of the 7th Street Extension, operates at LOS A (inbound and outbound) during the morning peak hour and Middle Harbor

Road, west of 3rd Street, operates at LOS B (inbound) and LOS A (outbound). During the afternoon peak hour of traffic, the LOS for those streets are as follows: Maritime Street is LOS B (inbound and outbound), Seventh Street is LOS B (inbound and outbound), and Middle Harbor Road is LOS A (inbound and outbound).

Existing Truck Traffic

Truck volumes on state highways are shown in Table 3.8.1.2-2 and taken from Caltrans's *Average Annual Daily Truck Traffic on the California State Highway System - 1991* (1992). The table shows that truck volumes vary from about 3 percent to almost 14 percent of total traffic volumes (one location was under 3 percent, but was counted prior to the 1989 earthquake and is probably not valid today). The composition of the trucks by number of axles is also shown below (the row percentages add up to 100 percent, representing all trucks).

Table 3.8.1.2-2. Annual Average Daily Truck Volumes

<u>Route/Location</u>	<u>Trucks</u>	<u>2 Axles</u>	<u>3 Axles</u>	<u>4 Axles</u>	<u>5+ Axles</u>
SR 24 at Junction I-580/I-980	3.4%	54.6%	9.9%	2.5%	33.0%
I-80 between Powell and SR 13	7.3%	33.6%	10.4%	2.3%	53.7%
I-80 at Bay Bridge Toll Plaza	4.4%	53.8%	11.2%	2.1%	32.9%
I-580 between SR 24/I-980 and San Pablo Avenue*	1.8%	63.4%	21.9%	3.5%	11.2%
I-880 south of Oak Street*	13.6%	20.9%	13.3%	2.8%	63.0%
I-880 north of Hegenberger Road	9.6%	37.8%	14.6%	8.6%	39.0%
I-980 at 14th Street	9.9%	38.7%	15.0%	10.6%	35.9%

Notes: * Indicates most recent count (shown) was taken prior to Loma Prieta earthquake of October 1989.
Source: Caltrans 1992.

The table above shows that two-axle trucks predominate in most locations, except on I-880 (Nimitz Freeway), where five or more axle trucks make up 63 percent of all trucks at this location, and on I-80 between Powell Street and Ashby Avenue (SR 13).

Data were collected at the three major entrances to the Port to establish the current volume of trucks to and from the Port. The time periods and results of this survey are as noted in Table 3.8.1.2-3. Most locations were counted during the afternoon (P.M.) peak traffic period (one entry to the Port, Middle Harbor Road westerly of Adeline Street, was analyzed for 36 hours with special automated monitoring equipment all day and night on 1/26/93 and until noon on 1/27/93. Other entrances were analyzed for shorter periods, using manual count methods). This table shows that although the truck volumes are significantly heavier than on typical city streets, the predominant vehicle at this location is still the auto (including passenger vans, motorcycles, and pick-up trucks).

All manual traffic counts were taken on Thursday, February 4, 1993, from 3 to 6 P.M. The counts indicated that truck use of city streets generally peaks in the afternoon between 3:30 and 4:30, which is

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somewhat earlier than the commuter peak of traffic. The table below shows traffic volumes (upper figure in row) and percent of total vehicles counted (lower figure in row) during the peak hour indicated.

DISTRIBUTION OF TRUCK TRAFFIC. A 1991 survey by the Port of Oakland (1991b). indicates that almost one-third of the garage locations of trucks working at the Port were reported as being in the City of Oakland. Almost 44 percent of the truck trips originate in Alameda County, with 33.5 percent of those trips originating in Oakland and 10.5 percent from the balance of Alameda County. Over 40 percent of the truck trips were destined for a place in Alameda County, with 30 percent within the City of Oakland and 10 percent to remaining locations. About 27 percent of the truck trips were on local streets (i.e., did not use any freeway) to reach the Port terminal areas. This includes both inbound and outbound trips.

Table 3.8.1.2-3. Peak Hour Traffic Counts and Vehicle Classification
(top figure is actual count; bottom figure is row percent)

<i>Location/Direction Peak Hour</i>	<i>Autos + Pickups</i>	<i>Truck 2-Axle</i>	<i>Truck 3-Axle</i>	<i>Truck 4-Axle</i>	<i>Truck 5-Axle</i>	<i>Total Vehicles</i>
7th Street Eastbound	497	16	41	2	93	639
3:30-4:30 P.M.	77.8%	2.5%	6.4%	0.3%	14.6%	100.0%
7th Street Westbound	198	3	12	0	61	284
3:45-4:45 P.M.	69.7%	4.6%	4.2%	0.0%	21.5%	100.0%
Maritime Street Northbound	301	4	35	2	62	404
3:30-4:30 P.M.	74.5%	1.0%	8.7%	0.5%	15.3%	100.0%
Maritime Street Southbound	1,150	12	55	3	126	404
3:30-4:30 P.M.	85.4%	0.9%	4.1%	0.2%	9.4%	100.0%
Middle Harbor Road Outbound	689	90	see note	see note	129	908
3:00-4:00 P.M. ¹	75.9%	9.9%			14.2%	100.0%
Middle Harbor Road Inbound	3,607	381	443	195	220	4,846
36 hours	74.4%	7.9%	9.2%	4.0%	4.5%	100.0%

Note: The outbound direction was counted in December 1989 by KORVE Engineering. The vehicle classification of trucks inbound and outbound is not likely to be significantly different, particularly when a long period of time (such as the 36 hours counted in the outbound direction) is covered. The count classified trucks as only "medium" and "large."

Rail Traffic

Train schedules are driven by shipper and Port needs, and so change frequently due to variations in demand. Additional trains are added when demand warrants, and conversely, are annulled when there is insufficient rail traffic. There are also local switching trains that may operate around the Port without a fixed schedule. Some general statements are provided below based upon schedules in effect in 1992.

The UP schedules three trains each weekday to points in the east, which generally depart in the afternoon and early evening. On weekends, additional eastbound trains are scheduled to coincide with international

1 traffic arriving at the Port. Normally there are two or three inbound trains from the east scheduled each
2 day, generally arriving in the late evening or early morning.

3
4 The Santa Fe operates eight trains a day into and out of Richmond to points south and east. Outbound
5 departures occur throughout the day. Scheduled arrivals also occur throughout the day. Many trains
6 operate during the late night/early morning hours.

7
8 The SPTC schedules the number and timing of trains on an "as needed" basis. There are 8 passenger
9 trains per day using the SPTC line along the Embarcadero (4 in each direction): the "Coast Starlight"
10 (Los Angeles-Seattle); and the three "Capitols" (San Jose-Sacramento). Additional train services
11 travelling north from the 16th and Wood streets passenger terminal include the "California Zephyr" (one
12 train in each direction) and the "San Joaquin" (4 trains in each direction). Thus, north of the 16th/Wood
13 depot, there are currently 18 passenger trains a day (9 in each direction). The area north of the
14 16th/Wood depot would be much less affected by truck traffic from the project, however.

15 16 *Railroad/Highway Grade Crossings*

17
18 Public rail/highway at-grade crossings occur at several locations around the Port. The SPTC mainline
19 travels in the center of the Embarcadero, from Webster Street to Clay Street. North of Clay, the
20 mainline is in its own exclusive right-of-way, but there are perpendicular grade crossings at most cross
21 streets. The UP mainline is in the center of 3rd Street, between Oak Street and Filbert Street, but is in
22 the process of being abandoned/consolidated in favor of the SPTC line (see description above under
23 Railroad Facilities). Additional grade crossings occur on the SPTC line at Middle Harbor, just south of
24 7th Street/7th Street Extension, and at Maritime Street south of 7th Street. Numerous other at-grade
25 crossings occur for sidings and spur tracks.

26 27 **3.8.2 Disposal Site Options**

28 29 **3.8.2.1 Ocean Section 102**

30
31 The discussion under section 3.8.1.1, Vessel Transportation, applies to this disposal site, as well.

32 33 **3.8.2.2 Alcatraz**

34
35 This site is located in San Francisco Bay. The discussion under section 3.8.1.1, Vessel Transportation,
36 applies to this disposal site, as well.

37 38 **3.8.2.3 Bay Farm Borrow Area**

39
40 This site is located in San Francisco Bay. The discussion under section 3.8.1.1, Vessel Transportation,
41 applies to this disposal site, as well.

3.8.2.4 Leonard Ranch/Redwood Landfill

Introduction

This section covers the transportation and traffic setting associated with the Leonard Ranch site in Sonoma County (near the intersection of SR 37 and Lakeville Highway-Reclamation Road) and the Redwood Landfill (located in Marin County north of Novato, near the Marin/Sonoma County line on Highway 101). The setting deals primarily with the highway and rail facilities connecting these two sites, since dewatered dredge material is expected to be moved from the Leonard Ranch area to the Redwood Landfill for final disposal. No ground transportation is expected for dredged material moved from the Port of Oakland to the Leonard Ranch site, since this will occur by barge and a slurry pipeline.

Physical Characteristics of the Ground Transportation System

REGIONAL HIGHWAY SYSTEM

Figure 3.8.2.4-1 shows a regional map of transportation facilities. Regional access to the Leonard Ranch site is served by SR 37, a four-lane expressway between the City of Novato and SR 121 with a wide median and shoulders (there is no median barrier on SR 37, however). Except east of Lakeville Highway, the terrain is nearly flat, and sightlines are very good. West of SR 121, SR 37 narrows to two through lanes (one in each direction). The posted speed limit in this area is 55 mph.

SR 37 connects to U.S. 101 at Novato, which is the most important route connecting the central Bay Area to its northern counties (Marin and Sonoma), and the North Coast (Mendocino, Lake, Humboldt, and Del Norte counties). U.S. 101 is a freeway with full access control, except that between Novato and south Petaluma, it is a divided expressway with a median guardrail. From SR 37 to near the Rowland Avenue interchange on U.S. 101, there are three mixed flow and one commuter lane in each direction. The commuter lanes are restricted to carpools (two or more occupants) and buses in the southbound direction in the morning commute peak, and the northbound direction in the afternoon commute peak. From near the Rowland Avenue interchange to just north of the San Marin/Atherton Avenue interchange, there are three mixed flow lanes in each direction. From north of the Atherton interchange to Petaluma, there are four through lanes (two in each direction). Between Atherton and the South Petaluma Boulevard ramps, U.S. 101 is classified as an expressway, with some access control. U.S. 101 provides the regional access route to the Redwood Landfill site, and is located at approximately post mile 26, about 3 miles north of Novato and 2 miles south of the Marin/Sonoma County line. The posted speed limit is 55 mph.

SR 37 and U.S. 101 are part of the congestion management program designated highway systems for Marin and Sonoma counties; part of the Metropolitan Transportation Commission's metropolitan transportation system routes, and are candidates for the National Highway System of designated routes now being studied by Caltrans.

Caltrans prepares "route concept reports" for state highways, expressing the department's long-term intentions regarding improvements of its facilities. Generally, these are for a timeframe of the year 2005 or later, and the route concepts are not financially constrained (i.e., the route concept is driven by demand projections, regardless of estimates of future available funding). For SR 37, the approved route concept is for a six-lane freeway (including widening the bridge over Petaluma River to include

REGIONAL HIGHWAY SYSTEM NEAR LEONARD RANCH/REDWOOD LANDFILL

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shoulders), and for U.S. 101, it is for an eight-lane freeway. However, Sonoma County's *Circulation and Transit Element* (adopted 1989) calls for U.S. 101 in this area (from SR 37 north to Windsor) to be a six-lane freeway; in neither case have timing or specific funding sources for these improvements been identified. It is likely that these improvements would occur after the current state transportation improvement program is completed (i.e., after 1999).

COUNTY AND OTHER ROADS

Lakeville Highway is a Sonoma County roadway that provides an important connection between Petaluma and SR 37. The posted speed limit is between 45 and 55 mph (the slower speed applies closer to the Petaluma urban limits). The road is a two-lane roadway, and is relatively flat. Adjacent land uses include some commercial uses in the Petaluma urban area, but are primarily large-lot residential and agricultural between the Petaluma city limits and SR 37. There is a signalized, at-grade intersection on Lakeville Highway at SR 37. South of SR 37, Lakeville Highway becomes a stub road called Reclamation Road that serves the Leonard Ranch site. Sonoma County's *Circulation and Transit Element* calls for Lakeville Highway eventually to be upgraded to a four-lane road. The County has an application pending for \$470,000 of federal funds to modify the eastbound left-turn channelization on SR 37 at Lakeville Road, add right turn channelization on southbound Lakeville Highway, and modify signalization and safety lighting at the intersection.

Sanitary Landfill Road carries all traffic into and from the Redwood Landfill. This is a two-lane road. The intersection with U.S. 101 is a "T" intersection, with a stop sign on Sanitary Landfill Road and no control for the U.S. 101 traffic. On U.S. 101 southbound, a left-turn deceleration lane is provided for traffic turning into the landfill, and an acceleration lane is provided for traffic turning from the landfill into U.S. 101 southbound. From U.S. 101 northbound, traffic turning right into the landfill is provided with a wide apron that minimizes the delay to through traffic, although no separate right-turn deceleration lane is provided.

Atherton Avenue is a two-lane road that widens to four lanes near the U.S. 101 freeway interchange. A diamond-type interchange is provided, with two signalized intersections at the freeway ramps. Atherton Avenue provides a short-cut between U.S. 101 in north Novato and SR 37, and is frequently used for that purpose. Land uses along Atherton Avenue are generally open space, agricultural, or low density residential.

Binford Road is a stub road that comes within a few miles of the Redwood Landfill. There have been proposals to extend Binford Road to the landfill in order to provide alternative access using the Atherton Avenue-San Marin Drive interchange.

RAILROAD FACILITIES

Both the Leonard Ranch and Redwood Landfill sites are directly adjacent to the tracks of the SPTC (formerly the Northwestern Pacific Railroad. In late 1992, the NWPRR was absorbed into the SPTC, losing its separate corporate identity. This change had no practical effect on operations.). This is a single track line, with passing tracks (sidings) provided at strategic points (the Ignacio siding is near the wye, which is a track arrangement providing for movements of trains in three directions); the Novato siding is just south of downtown Novato; and the Burdell siding is located about 3 miles north of Novato adjacent to Burdell Mountain). The rail line follows SR 37 and U.S. 101; an all-direction wye is

provided near the junction of SR 37 and U.S. 101. Train speeds are restricted to 25 mph in this area (SPTC 1986). Track gradients are nearly level, with the maximum grade of one percent occurring just north of Novato, and horizontal curves are relatively gentle. While the rail line extends south of Ignacio, it is understood that no service is being provided on this portion of the line (the "San Rafael branch"). Rail service terminates at Ignacio.

The line is currently operated by direct traffic control, which essentially involves a central dispatcher giving instructions to train crews via radio. There is no other signalling apparatus, except for adjacent to the track junctions near the Ignacio wye and at Schellville.

Existing Traffic Volumes and Level of Service

Caltrans indicates the following AADT on SR 37 (Caltrans 1992):

Novato (Junction U.S. 101 to Atherton Avenue)	33,500
Atherton Ave. to Petaluma River Bridge	35,500
Petaluma River Bridge to Lakeville Highway	34,500
Lakeville Highway to SR 121 North	38,000

During peak travel months (July-August), traffic volumes are approximately 15 percent higher than this. The capacity of a four-lane expressway at level of service "C" (see Existing Intersection Level of Service and Congestion above) is approximately 35,000 vehicles per day, so SR 37 is operating near this level today. Peak traffic occurs during weekday commute periods (7 to 9 A.M. and 4 to 6 P.M.), as well as on weekends due to recreational traffic (Figure 3.8.2.4-2).

The existing AADT volumes on U.S. 101 are as follows:

SR 37 to Rowland Avenue	97,000
Rowland Avenue to DeLong Avenue	83,000
DeLong Avenue to Atherton Ave.-San Marin Dr.	70,000
Atherton Avenue to South Petaluma Blvd. interchange	68,000

Peak month volumes are approximately 11 to 16 percent higher than this, depending on the locations. The capacity of U.S. 101 has been estimated at about 75,000 vehicles per day at an acceptable level of service in the four-lane sections (i.e., just north of Atherton Avenue to South Petaluma Boulevard), and 113,000 vehicles per day in the six-lane section (most of the area south of the Atherton Avenue interchange).

PEAK PERIOD CHARACTERISTICS OF TRAFFIC

Information available from Caltrans was used to assess the existing peaking characteristics of traffic. Data on U.S. 101 were available in the northbound direction only for the area under consideration. Figure 3.8.2.4-2 shows SR 37 traffic flows (in vehicles per hour, vph) near Novato Creek (just east of U.S. 101). The peaking pattern is the classic bi-modal peak, occurring between 7 to 8 A.M. and 4 to 6 P.M., due to commute traffic. The heaviest westbound movement occurs from 7 to 8 A.M. (about 2,100 vph), and the heaviest eastbound traffic occurs 4 to 6 P.M. (about 1,700 vph).

The South Petaluma Blvd. ramp volumes are shown in Figure 3.8.2.4-3. These also show a bi-modal distribution, with a peak on-ramp volume in the southbound direction of about 700 VPH between 6 and 7 A.M.; and a peak northbound off-ramp volume of 600 VPH occurring from 5 to 6 P.M. It is surmised that the southbound volume at these ramps is higher because it allows traffic to bypass some of the early morning congestion that occurs north of these ramps in the A.M., but not the P.M., peak periods.

Current recurring congestion occurs in the following area for the reasons stated:

A.M. Peak: A bottleneck exists on U.S. 101 southbound near the South Petaluma Blvd. ramps because of (1) the high volume of entering traffic in the A.M. peak and (2) a reduction in capacity as the facility changes from a freeway to an expressway. The maximum queue (the term "queue" means a group of waiting vehicles) extends as far north as the SR 116 East (Lakeville Highway) ramps, and sometimes farther.

In Novato, another bottleneck exists where SR 37 traffic making the westbound to southbound transition converges with U.S. 101 southbound traffic. This is caused by the high A.M. peak volumes on both facilities (Figure 3.8.2.4-4). The maximum queue can extend from SR 37 to the Atherton Avenue interchange. There is no recurring congestion in this area in the northbound direction in the A.M. peak.

P.M. Peak: A bottleneck exists north of the Atherton Avenue interchange in the P.M. peak, where there is a reduction in the number of lanes from three to two in the northbound direction. This is worsened by the fact that the freeway ends here and becomes an expressway, reducing capacity. The maximum P.M. peak queue typically extends to south of the Atherton Avenue interchange, to about the DeLong Avenue (downtown Novato) interchange. There is no recurring congestion in this area in the southbound direction in the P.M. peak.

Other available peak period traffic volumes are shown in Figure 3.8.2.4-5.

INTERSECTION LEVEL OF SERVICE AND CONGESTION

Traffic counts (see Figure 3.8.2.4-6) at Lakeville Highway/SR 37 indicate that peak traffic occurs between 7 to 8 A.M. and 4:45 to 5:45 P.M. on weekdays, due to commuter traffic. During both the A.M. and P.M. peak, the intersection operates below capacity. During the A.M. peak, about 84 percent of the capacity is used, while during the P.M. peak, about 66 percent of the capacity is used (method: *1985 Highway Capacity Manual* signalized planning method). However, it is considered undesirable for an intersection to operate at much more than 85 percent of capacity, since delays mount rapidly as traffic volumes increase beyond that point.

Lakeville Highway currently carries approximately 16,000 vehicles per weekday north of Cannon Lane (count by Sonoma County Public Works, July 1990). Cannon Lane is about 4 miles north of SR 37.

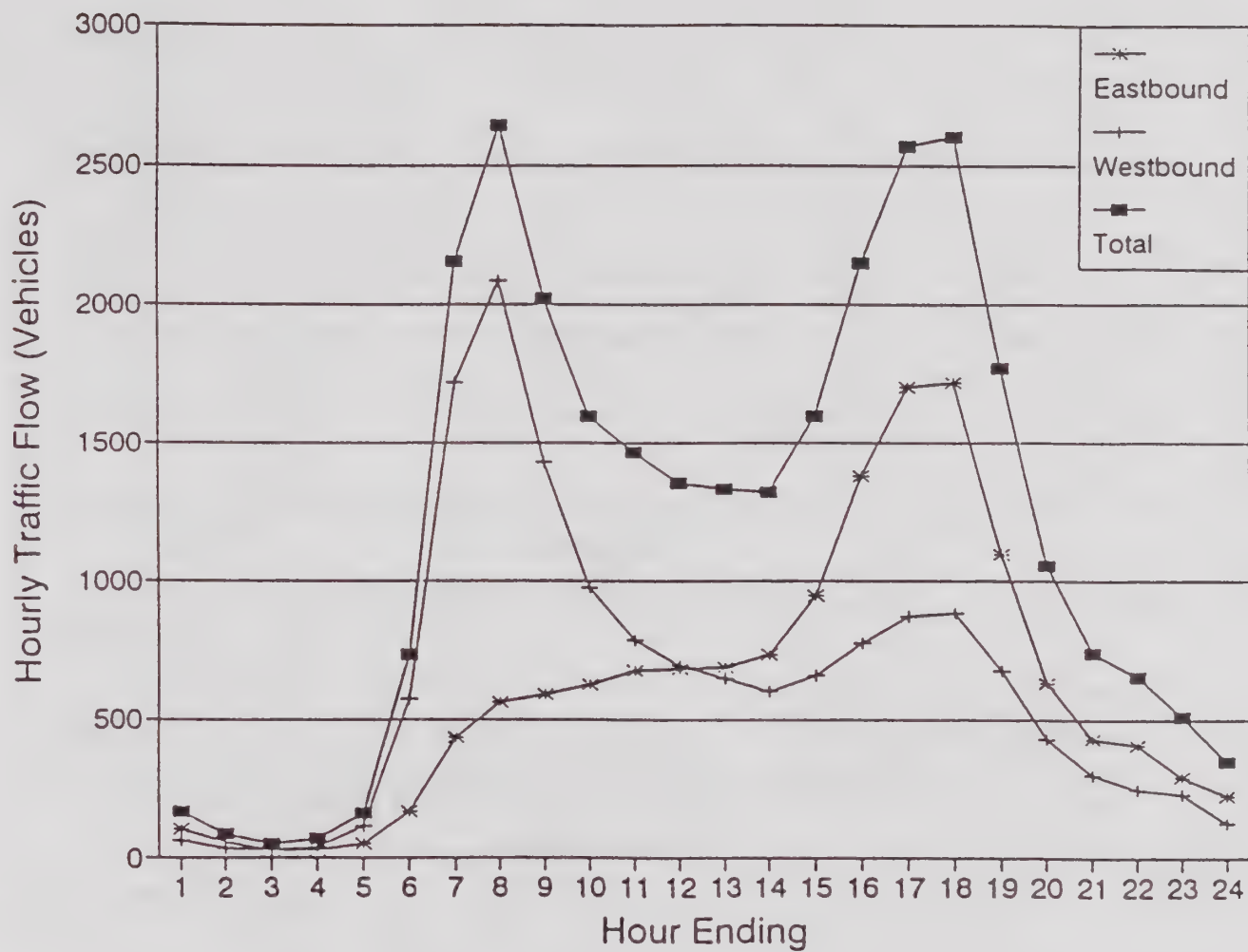
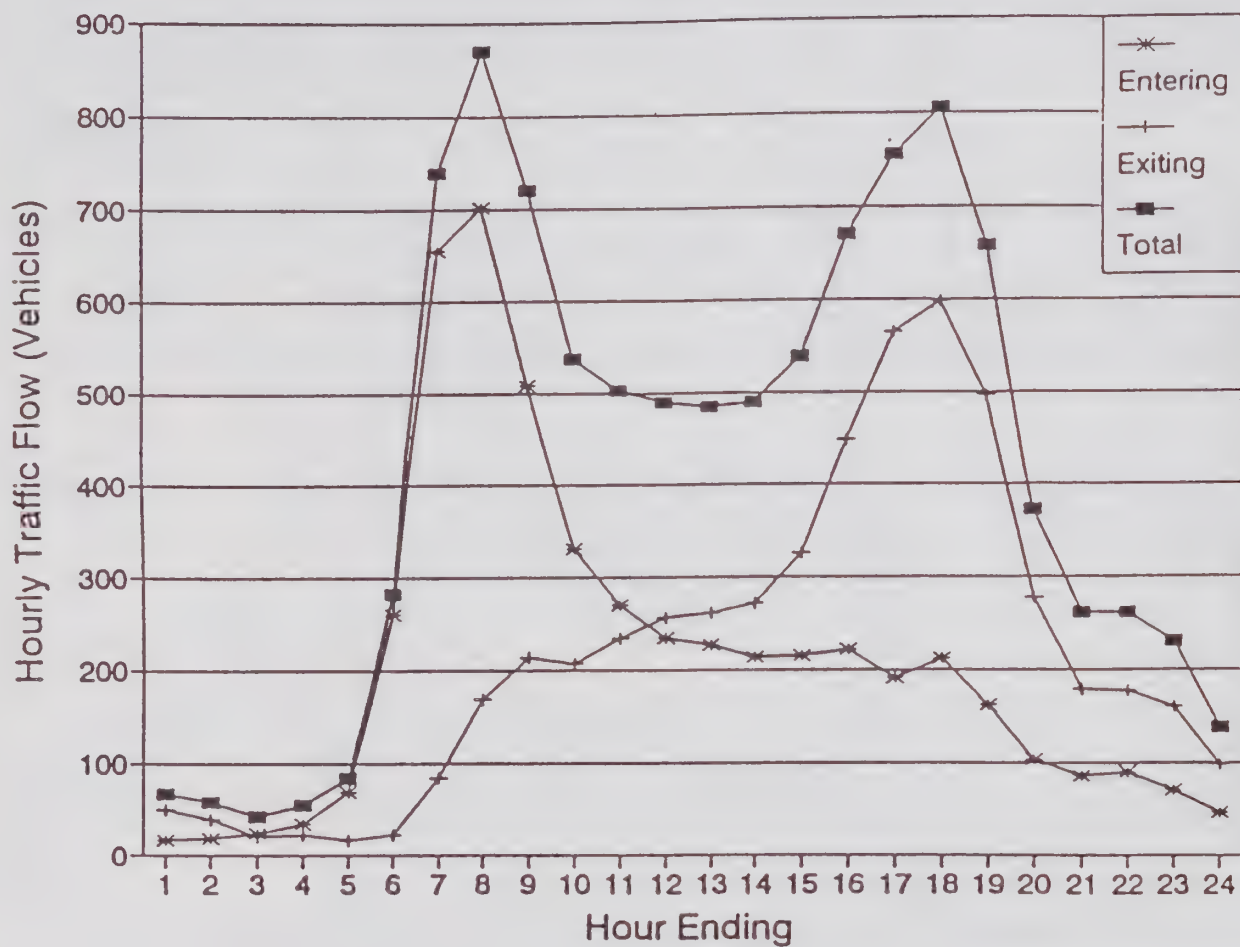


Figure 3.8.2.4-2

SR 37 AT NOVATO CREEK, HOURLY TRAFFIC FLOW



Source: Caltrans, March 1992

Figure 3.8.2.4-3

SOUTH PETALUMA BOULEVARD RAMPS TO/FROM U.S. 101, HOURLY TRAFFIC FLOW

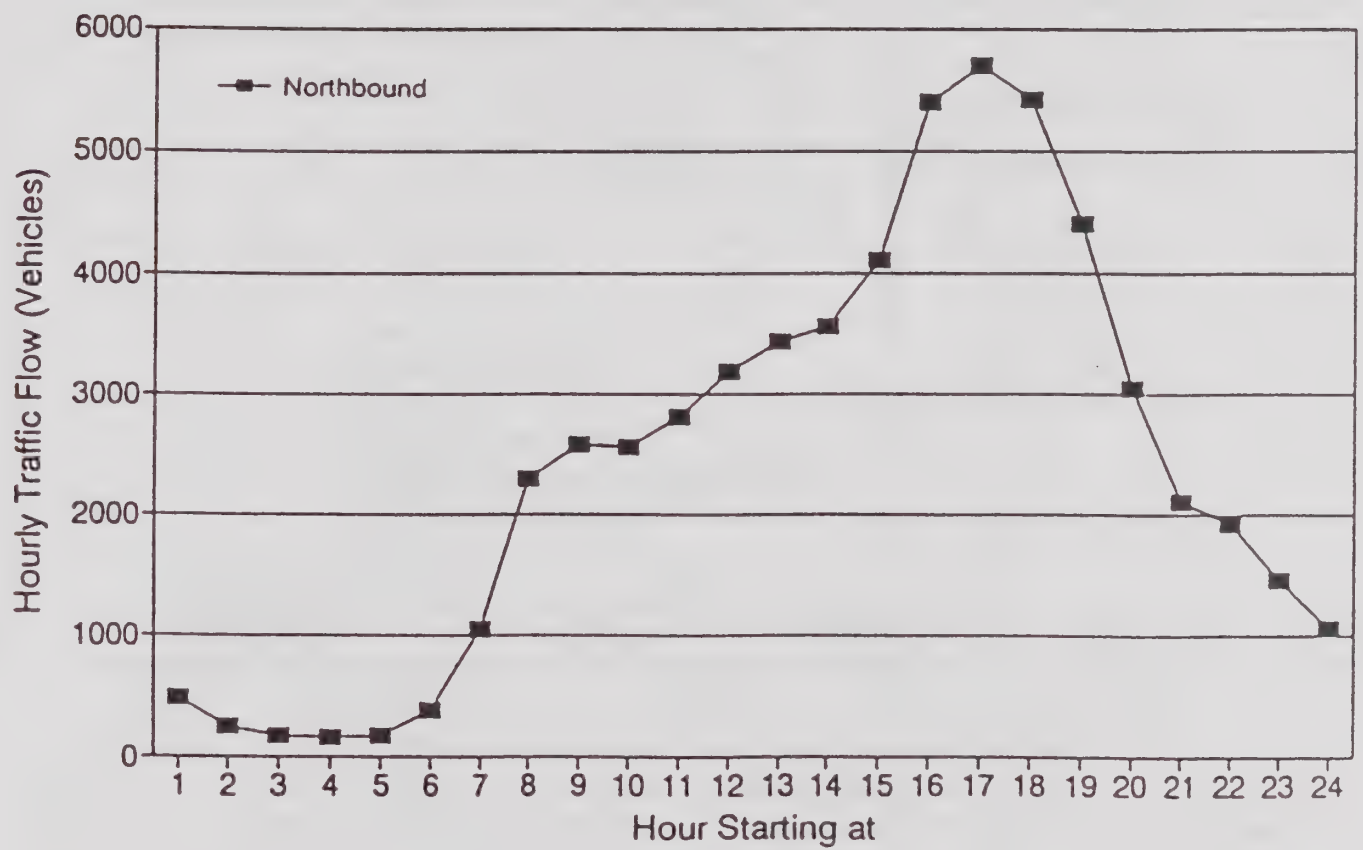


Figure 3.8.2.4-4

U.S. 101 MAINLINE NORTH OF SR 37, HOURLY TRAFFIC FLOW NORTH BOUND

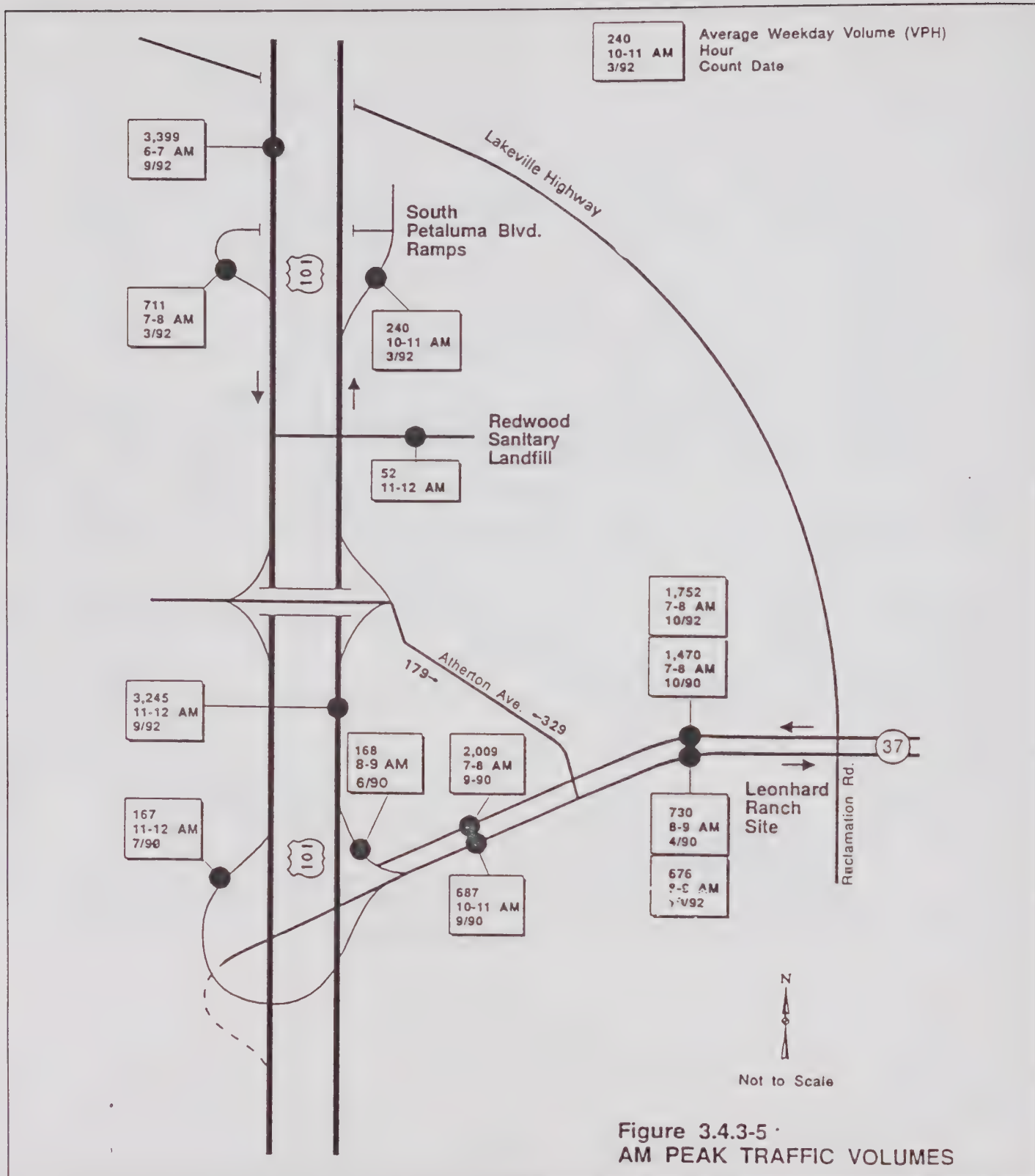


Figure 3.8.2.4-5

AM PEAK HOUR TRAFFIC VOLUMES NEAR LEONARD RANCH/REDWOOD LANDFILL

The peak northbound volume occurs at 3 to 4 P.M. and is 1,262 vph; the peak southbound volume occurs 6 to 7 A.M. and is 717 vph. Daily traffic counts on Sanitary Landfill Road are 720 vehicles per weekday (total both directions), and on Atherton Avenue, 6,200 vehicles per weekday.

The intersection of Sanitary Landfill Road and U.S. 101 currently operates at level of service "F", which indicates long delays for vehicles turning out of Sanitary Landfill Road, especially making the left turn. Level of service is a method of qualitatively assessing how well an intersection is working. The levels of service for unsignalized intersections is explained in Table 3.8.2.4-1 below. Entering traffic volume counts (Abrams Associates 1992) are shown in Figure 3.8.2.4-7.

Table 3.8.2.4-1. Level of Service Definitions for Unsignalized Intersections

<u>Level of Service</u>	<u>Expected Delay</u>	<u>Reserve Capacity (vehicles/hour)</u>
UA	Little or no delay	≥ 400
UB	Short traffic delay	300-399
UC	Average traffic delays	200-299
UD	Long traffic delays	100-199
UE	Very long traffic delays	0-99
UF	Extreme delays potentially affecting other traffic movements in the intersection	≤ 0

Source: Highway Capacity Manual, Special Report 209, Transportation Research Board, Washington, D.C. 1985.

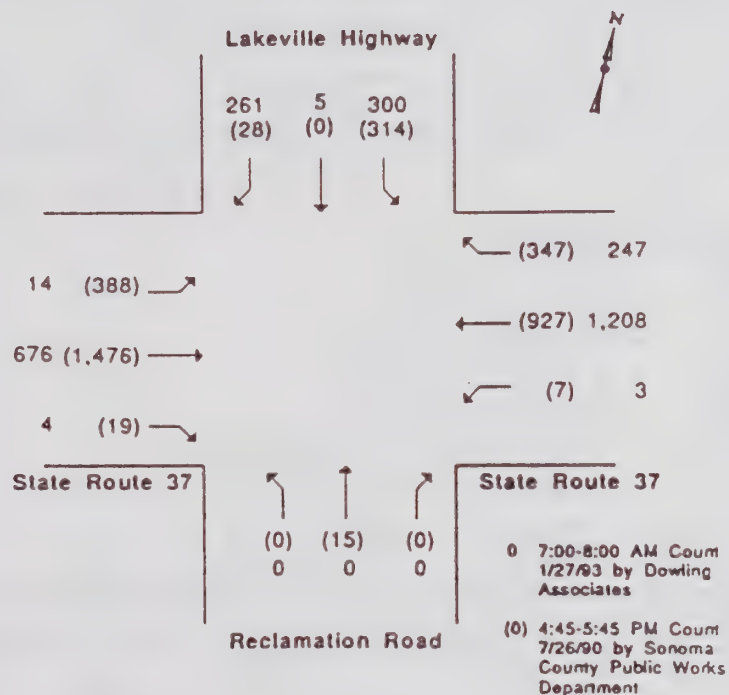
TRUCK TRAFFIC

Truck volumes are taken from Caltrans's *Average Annual Daily Truck Traffic on the California State Highway System - 1991*. Caltrans estimates that on U.S. 101 between SR 37 and South Petaluma Blvd., trucks averaged between 5.5 and 6.5 percent of all vehicles (depending on location). Of these trucks, the approximate breakdown by number of axles is: 43 percent 2-axle; 12 percent 3-axle; 4 percent 4-axle; and 42 percent 5-axle.

On SR 37, the approximate truck percentage is 4.5 percent between U.S. 101 and Lakeville Highway. The mix of trucks is 40 percent 2-axle; 12 percent 3-axle; 6 percent 4-axle; and 42 percent 5-axle. Truck travel is higher between Lakeville Highway and SR 121: 7.1 percent of all traffic.

RAIL TRAFFIC

According to reports published in the popular press, the SPTC has been operating only a few trains per week on this line, due to the lack of demand. There is no fixed schedule for freight trains; they are instead scheduled on an "as needed" basis. Switching locomotives are stationed in Petaluma. The line mainly carries finished lumber and other wood products from Mendocino and Humboldt counties to the Bay Area (Ignacio near SR 37), and points south and east. An interchange at Schellville (Sonoma

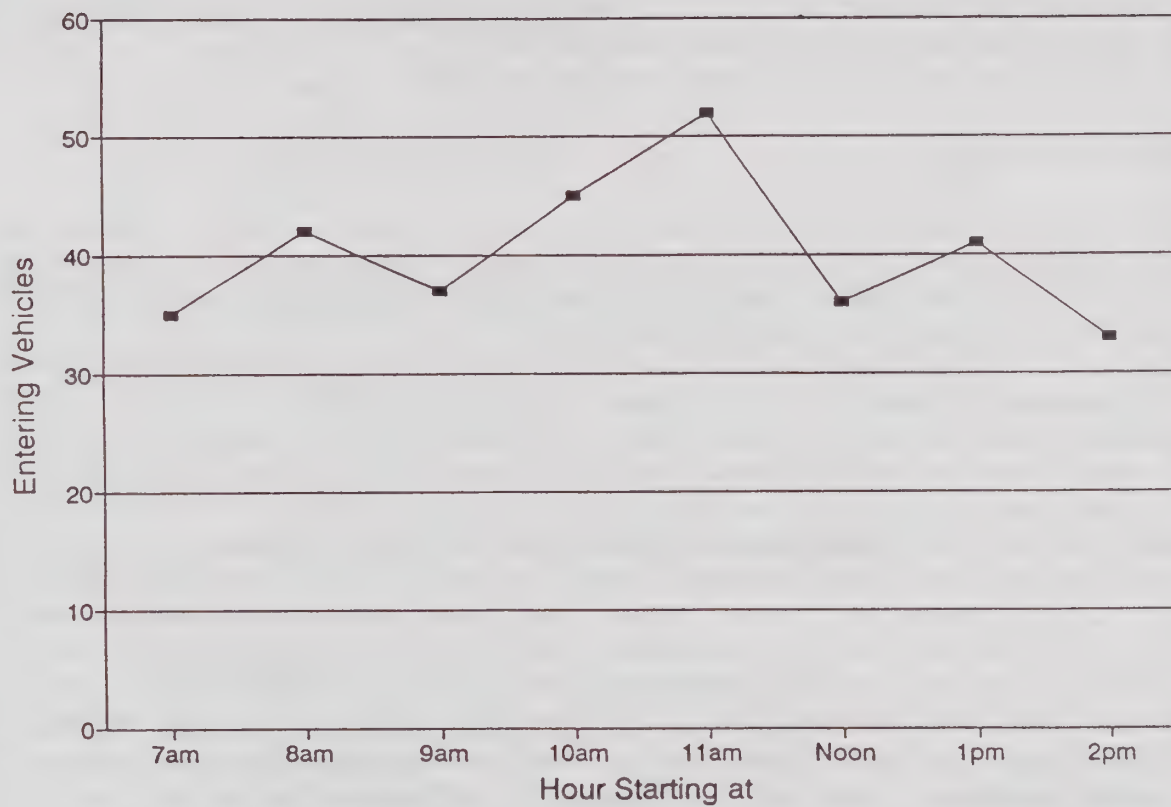


00 = 7:00-8:00 AM count 1/27/93 by Dowling Associates

(00) = 4:45-5:45 PM count 7/26/90 by Sonoma County Public Works Department

Figure 3.8.2.4-6

PEAK HOUR TURNING MOVEMENT COUNTS – SR 37 AND LAKEVILLE HIGHWAY



Source: Abrams Associates.

Figure 3.8.2.4-7

HOURLY TRAFFIC VOLUMES ENTERING REDWOOD SANITARY LANDFILL ROAD, 1992

County) provides connections with SPTC's national rail system. Approximately 10 years ago, the portion north of Willits was sold to a shortline operator (it is now operated by a public agency, the North Coast Rail Authority). Published reports report that the Northwestern Pacific line is not profitable and indicate that SPTC would like to sell it to others. A small operator (public or private) would not be subject to some of the regulatory and labor restrictions, and might be able to operate the line profitably.

Regularly scheduled passenger train service on this portion of the railroad was last operated in 1962. While there has been discussion of operating commuter train service on the portion of the line paralleling U.S. 101, such service is unlikely to occur before the year 2000.

Accidents and Safety

HIGHWAY

Accident data were obtained from Route Concept Reports for SR 37 and U.S. 101. These were prepared in 1985 and 1986, respectively, and the accident period covered 1981-1983, inclusive (at the time of this writing (June 15, 1994), Caltrans had not responded to a request for more written accident information). SR 37 experiences its greatest number of accidents around noontime, and between 7 to 8 P.M. The total accidents for the section from U.S. 101 to Petaluma River (Marin/Sonoma County line) and from there to the Napa County line were considerably less than the statewide accident rate for this type of facility. The accident rates along U.S. 101 are slightly below the statewide average for the type of highway facility in question. The STOP sign-controlled intersection of U.S. 101 and the Sanitary Landfill Road presents a problem because of the high speed of traffic involved and the high percentage of trucks turning into or out of this intersection. Over a 3.5-year period, a total of 20 accidents were recorded at this location. These accidents resulted in three fatalities and 20 injuries. A calculation of the accident rate per million vehicles approaching the intersection confirms that the accident rate is not unduly high in comparison to statewide averages (Abrams Associates 1992). However, the number of fatalities and injuries suggest that at-grade crossings and high speeds pose a safety problem. Although the number of accidents are large enough to justify consideration of a traffic signal (warrants for installing traffic signals on state highways are established in Chapter 9 of the Caltrans *Traffic Manual*. The accident warrant (#6) requires that there be at least five reported accidents *of the type susceptible to correction by traffic signal control* in a 12 month period. Even then, the installation of a signal is subject to engineering judgment and qualitative considerations), the minimum vehicular volumes are not satisfied under current traffic conditions. It is likely that a placement of an isolated signal at a location like this could increase the number of accidents (because rear-end type accidents generally increase, and broadside accidents decrease, when a signal is installed).

Caltrans prepared an accident analysis of the SR 37/Lakeville Highway-Reclamation Road intersection (Ebrahimi 1993). That analysis indicated that SR 37 experienced a total of 34 accidents between 10/1/89 and 9/30/92 for the segment between U.S. 101 and Lakeville (but excluding the SR 37/Lakeville intersection). Eighteen of these involved injuries, but there were no fatalities. For this same time period, the SR 37/Lakeville intersection had 38 accidents, of which 19 were property damage only, 18 were injury, and one involved a fatality. The average number of intersection accidents (12.7 per year) places this intersection in the problematic category. Speeding was the greatest collision factor (in 55 percent of the accidents), with rear end collisions being the predominant type of collision (45 percent of all accidents). Trucks were involved in 21 percent of the accidents. For rural signalized intersection, the

"expected accident rate" is 0.7 per million vehicles (Caltrans 1992). The actual rate over the three years analyzed has been approximately 0.9 per million vehicles.

RAIL

Public rail/highway at-grade crossings occur at several locations between Leonard Ranch and the Redwood Landfill. Some of these crossings include:

- Hamilton Army Airfield
- Downtown Novato
- Redwood Sanitary Landfill Road

The potential for accidents is reduced somewhat by the relatively slow speed (25 mph) to which trains are restricted in this vicinity. In addition, observations indicate that many train movements are made late in the evening or in the early morning, when conflicting traffic volumes are lowest.

3.8.2.5 Sonoma Baylands

The land-based transportation setting for Sonoma Baylands is essentially identical to that described for Leonard Ranch (see section 3.8.2.4).

The water-based transportation system is essentially identical to that described for Leonard Ranch (see section 3.8.2.4).

3.8.2.6 Galbraith Golf Course

Galbraith Golf Course is located within the City of Oakland, in the East Bay area. The golf course is bordered on the east by Doolittle Drive and on the north by Airport Drive. Main access to the site is from Doolittle Drive. I-880 provides access to Doolittle Drive via Davis Street from the south, or Hegenberger Road from the north. The project area is industrial/commercial in nature with traffic mixes typical of such areas. Airport traffic dominates the circulation patterns immediately north of the project site.

San Leandro Bay, just north of the site, has no commercial vessel traffic, and no information could be obtained on the extent of recreational boat traffic in this bay.

The movement of the dredge spoils to this site would not affect the ground transportation or the water navigation systems since the spoils would be transported through a pipeline.

Most of the traffic impacts from construction of the dredged material drying facility and reconstruction of the golf course are expected to occur on routes to and from the Nimitz freeway (I-880). These routes include Hegenberger Road, which is a six-lane divided road from I-880 to Doolittle Drive (State Route 61); this road has several signals along it at key intersections and turning lanes provided for both property access and at intersections along its length. Ninety-eighth Avenue is a two-lane highway for most of its length. Route 61 is a conventional state highway that includes Davis Street and Doolittle Drive. SR 61 connects San Leandro, the Oakland Airport area, and continues north to Alameda Island. An area map is shown in Figure 3.8.2.6-1.

Existing Weekday Traffic Volumes and Levels of Service

The existing daily (weekday) traffic volumes and levels of service are shown below. Levels of service (LOS) have been based on the facility type, the number of lanes, and the signal spacing using capacities in the 1985 *Highway Capacity Manual*.

	<u>ADT</u>	<u>LOS</u>
Airport Drive		
- west of Doolittle	23,850	B
- east of Doolittle	20,800	B
Doolittle Drive (Route 61)		
- near Club House entrance	26,500	B
- near Swan Way	30,000	C
- near Harbor Bay Parkway	23,100	B
98th Avenue	18,800	C
Hegenberger Road	40,300	D/E

Note: * Average daily (weekday) traffic.

LOS A and B generally represent excellent traffic operating characteristics with little delay. LOS C and D indicate increasing amounts of delay and congestion, but are still considered acceptable for urban areas (including the City of Oakland). LOS E represents excessive delays, with volumes near the capacity of the street or intersection. LOS F represents extreme delays with long back ups at intersections and slow travel in mid-block areas, and a possible reduction in capacity.

Doolittle Drive and Hegenberger Road are designated truck routes. Doolittle Drive has both right and left turn lanes approaching the golf course, which minimize any negative safety or delay effects to through traffic.

Weekend (Saturday/Sunday) traffic volumes were not available, although traffic LOS is known from observation to be better on weekend than weekdays.

3.8.2.7 Port/Landfill

Transportation conditions along the routes leading to the three alternative landfill sites are discussed below.

West Contra Costa Sanitary Landfill (Richmond Sanitary Service)

This site is located near San Pablo Bay at the foot of Parr Boulevard (Figure 2.7.7-2). The primary access routes to this site include I-580, a six-lane freeway; Parr Boulevard, a two-lane road; the North Richmond Parkway; and Castro Street. Recurring traffic congestion occurs on I-80 throughout much of the day between the Bay Bridge distribution structure and the I-580 in Albany. In the morning peak (6 to 9 A.M.), Caltrans indicates congestion occurs in the southbound direction on I-80 from SR 4 in Hercules to the Bay Bridge distribution structure (I-80/I-580 interchange) (Caltrans 1993). In the

Setting – Transportation and Circulation

1 SR 12 Operations. The highest traffic volumes on regional roads within the general vicinity of the site
2 occur on SR 12. According to a 1990 Caltrans traffic study in the area, SR 12 has a peak hour ADT of
3 2,950 vehicles at the Grizzly Road/SR 12 junction, a peak-hour ADT of 1,550 vehicles at the Scandia
4 Road/SR 12 junction, and a peak hour ADT of 1,550 vehicles at the Birds Landing (SR 113)/SR 12
5 junction.
6

7 Local Street System Operations. Given the rural nature of the project area and the low density of
8 development, the daily volume of traffic is fairly light. Traffic counts taken in 1990 indicate that there
9 is an ADT of 307 vehicles on Shiloh Road south of SR 12. There is an ADT of 250 vehicles taken in
10 1979 on Shiloh Road west of Collinsville Road, and an ADT of 225 vehicles taken in 1984 on Shiloh
11 Road south of Little Honker Bay Road.
12

13 Birds Landing Road is another primary point of access from SR 12 other than Shiloh Road. According
14 to a traffic count taken in 1990, it has a northbound ADT of 158 vehicles and a southbound ADT of 135
15 vehicles south of SR 12. There is an ADT of 202 vehicles taken in 1990 on Birds Landing Road east
16 of Collinsville Road, and an ADT of 48 vehicles taken in 1982 on Birds Landing Road west of
17 Collinsville Road.
18

19 Collinsville Road is the closest main road to the project site and will be used for every vehicle trip into
20 and out of the site. There is an ADT of 303 vehicles taken in 1990 on Collinsville Road south of Birds
21 Landing Road, an ADT of 290 vehicles taken at the same time on Collinsville Road south of Dinkelspiel
22 Road, and an ADT of 139 vehicles taken in 1982 on Collinsville Road south of Talbert Lane. Talbert
23 Lane intersects Collinsville Road just north of the Fire Truck Road/Collinsville Road intersection.

3.9 HUMAN HEALTH RISK ASSESSMENT

Human health risk assessments (HHRAs) were conducted to evaluate potential health risks associated with proposed disposal of dredged sediment from the Oakland Harbor at three potential upland disposal sites: the Leonard Ranch Rehandling Site (Leonard Ranch/Redwood Landfill; Sonoma County, California), the Galbraith Golf Course (Oakland, California), and the Ninth Avenue Marine Terminal (Port/Landfill; Oakland, California). The HHRAs evaluated potential human health impacts to various human receptors that could be exposed to chemicals from the proposed project. Potential impacts to human health are incorporated into the determination of suitability for ocean and bay disposal. Therefore, no HHRA was conducted for the aquatic disposal sites. The possible receptors evaluated at each of the three upland sites are identified below.

3.9.1 Leonard Ranch/Redwood Landfill

Existing land uses at and surrounding the Leonard Ranch Rehandling Site are described in section 5.3.4.1. Meteorological conditions in the vicinity of the site are described in section 3.1.1. Receptors evaluated in the HHRA include the following:

- Off-site child and adult residents currently living near the Leonard Ranch Rehandling Site.
- On-site dredged sediment workers present on the property during proposed loading and hauling activities.

3.9.2 Galbraith Golf Course

Existing land uses at, and surrounding the Galbraith Golf Course are described in section 5.3.6.1. Meteorological conditions in the vicinity of the site are described in section 3.1.1. Receptors evaluated at the HHRA include the following:

- Off-site child and adult residents currently living near the golf course.
- Off-site workers and golfers at the nearby driving range and snack bar.
- Off-site workers at nearby businesses.
- On-site dredged sediment workers working at the golf course during proposed tilling and grading activities.
- On-site golf course maintenance workers working at the golf course following completion of the proposed redevelopment activities.

3.9.3 Port/Landfill

Existing land uses at, and surrounding the Ninth Avenue Marine Terminal site are described in section 5.3.7.1. Meteorological conditions in the vicinity of the site are described in section 3.1.1. Receptors evaluated in the HHRA include the following:

- Off-site child and adult residents currently living near the Ninth Avenue Marine Terminal.
- Off-site industrial workers adjacent to the Ninth Avenue Marine Terminal.
- Dredged sediment workers present on the property during proposed tilling, loading and hauling activities.

4.0 ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

The environmental effects and recommended mitigation measures associated with use of the eight potential sites for dredged material disposal are described in this chapter. This chapter is organized by resource, and includes air quality; hydrology, groundwater, and water quality; geology, soils, and seismicity; biological resources; cultural resources; noise; socioeconomics; and transportation and circulation.

SAIC prepared the analysis for the Ocean Section 102 site, Alcatraz, Bay Farm Borrow Area, and the Montezuma Wetlands site. The impact assessment for these sites is based largely on the following environmental documents that were identified as key references.

<u>Disposal Site</u>	<u>Key References</u>
OCEAN SECTION 102	<i>San Francisco Bay Deep Water Dredged Material Disposal Site Designation Final EIS</i> (EPA 1993a). <i>Ocean Dumping; Proposed Designation of Site</i> (EPA 1994a). <i>Proposed Site Management and Monitoring Plan for an Ocean Dredged Material Disposal Site off San Francisco, California</i> (EPA 1994b).
ALCATRAZ	<i>Appendix D, Finding of No Significant Impact (FONSI) and Environmental Assessment, Oakland Inner Harbor 38-Foot Separable Element of the Oakland Harbor Navigation Improvement Project, Design Memorandum, Alameda County, California</i> (COE 1992a). <i>Oakland Harbor Deep Draft Navigation Improvements, Design Memorandum #1 (General Design), and Final Supplement to the Environmental Impact Statement, Alameda County, California</i> (COE 1988).
BAY FARM BORROW AREA	<i>Central San Francisco Bay Projects -- Dredged Material Disposal Site Investigation</i> (PTI 1989).
MONTEZUMA WETLANDS	<i>Administrative Draft Environmental Impact Report/Environmental Impact Statement, Montezuma Wetlands Project</i> , prepared by Brady and Associates (Solano County 1993).

Harding Lawson Associates (HLA), a consultant under contract to the Port of Oakland, prepared the impact assessment for the other four upland sites: the Leonard Ranch/Redwood Landfill option, Sonoma Baylands, Galbraith, and the Port/Landfill option.

This SEIR/S has been prepared in accordance with both the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) guidelines. Each of these guidelines provides criteria for determining the significance of environmental impacts on various resources that could occur from a proposed project. A general discussion of significance, as defined in the CEQA and NEPA

Impacts -- Environmental Effects and Mitigation Measures

guidelines, is provided below. A more detailed description of the criteria used to evaluate the significance of impacts on specific resources (e.g., air quality, biology) is provided at the beginning of each resource section.

CEQA

The following summarizes definitions of significance provided in CEQA Guidelines Sections 15064 and 15065 and Appendix F (California Office of Planning and Research 1986).

Section 15064, "Determining Significant Effect," states that the determination of the significance of a project impact requires careful judgment by the agency responsible for environmental review under CEQA (lead agency). The decision must, to the extent possible, be based on scientific and factual data and must be determined in context with the environmental setting. As stated in Section 15065, a project may have a significant environmental effect if:

- (a) The project has the potential to degrade the quality or range of the environment, or achieve short-term environmental goals to the disadvantage of long-term environmental goals;
- (b) The environmental effects of a project are individually limited, but cumulatively considerable when viewed in relation to other past, current, or future projects; or
- (c) The environmental impacts from a project would cause substantial direct or indirect adverse effects on human beings.

The Lead Agency, in this case the Port of Oakland, must consider both primary (direct) and secondary (indirect) impacts in evaluation of the significance of environmental effects from a proposed project. Primary or direct impacts are those immediately related to project actions (e.g., construction impacts), whereas secondary or indirect impacts can be removed in time or space from the direct impacts; however, they are caused in some ways by actions associated with the proposed project.

Appendix F of the Guidelines provides an outline of potential project effects that would typically be considered significant. Examples of project effects that would be viewed as significant include: substantial effects on a rare or endangered species or its habitat; substantial interference with the movement of any resident or migratory fish or wildlife species or substantial reduction of fish, wildlife, or plant habitat; substantial degradation of water quality or degradation/depletion of groundwater resources; substantial increases in flooding, erosion, or siltation; and conflict with adopted environmental plans and goals of the project area.

NEPA

The definition for the term "significantly" under the NEPA guidelines at 40 CFR 1508.27, requires consideration of both the context and intensity of the project impact. The definitions of context and intensity as provided in the NEPA guidelines, are presented below.

- (a) **CONTEXT.** This means that the significance of an action must be analyzed in several contexts, such as society as a whole (human, national), the affected region, the affected

interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short-term and long-term effects are relevant.

(b) **INTENSITY.** This refers to the severity of the impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

- (1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect will be beneficial.
- (2) The degree to which the proposed action affects public health or safety.
- (3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- (4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- (5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- (6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about future consideration.
- (7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulative significant impact on the environment. Significance cannot be avoided by terming an action temporary or breaking it down into small component parts.
- (8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historic resources.
- (9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
- (10) Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

As can be seen from the above overview of "significance" definitions, CEQA and NEPA use similar definitions concerning the evaluation of project impacts. Based on these broad definitions, significance

Impacts -- Environmental Effects and Mitigation Measures

- 1 criteria were developed and applied to the environmental impact assessment for each of the resource areas
- 2 evaluated by this document. The specific significance criteria used are presented at the beginning of each
- 3 resource section.

4.1 AIR QUALITY

The proposed action involves deepening the Oakland Harbor and transporting dredging spoils to potential disposal sites in the Bay Area region. The following sections discuss regional and site-specific air quality impacts that would occur from the proposed action. Feasible mitigation measures that would reduce or eliminate significant impacts are also identified.

Information on dredging and disposal emission sources was obtained from Port and Corps staff (personal communications with Jody Zaitlin [Port] and Roger Golden and Evan Hong [Corps]) and recent environmental documentation of relevant proposed activities (Solano County 1993). Emission inventories were estimated for each project activity and were based on reasonable worst-case assumptions. Emission factors used to calculate equipment emissions were obtained from *Compilation of Air Pollution Emission Factors, AP-42, Vols. I and II* (EPA 1985), EMFAC7PC (Randall and Ng 1989) and special studies on vessel emissions conducted for the California Air Resources Board (ARB) (1984). Detailed emission and equipment usage data associated with each project activity are contained in Appendix B.

4.1.1 Impact Significance Criteria

Criteria to determine the significance of air quality impacts are based on federal, state, and local air pollution standards and regulations. Impacts are considered to be significant if project emissions (1) increase ambient pollutant levels from below to above the National Ambient Air Quality Standards (NAAQS) or California Ambient Air Quality Standards (CAAQS), (2) substantially contribute to an existing or projected air quality standard violation, (3) are inconsistent with emission growth factors contained in the 1991 Clean Air Plan (CAP), or the 1993 Maintenance and Attainment Plans, or the 1982 Air Quality Plan (inconsistent projects include those exceeding the land use and population forecasts that were used to generate emission forecasts in these plans), or (4) exceed the following thresholds that the Bay Area Air Quality Management District (AQMD) defines as significant under CEQA: (a) one percent of the county emissions where the proposed action occurs for any pollutant or (b) Best Available Control Technology (BACT) trigger levels of 150 pounds per day of TOG, ROG, NO_x, SO₂, and PM₁₀ or 550 pounds per day of CO (BAAQMD 1985) (personal communication, J. Walser 1993).

4.1.2 Regional

4.1.2.1 Emissions from Combustion Sources

The proposed dredging and disposal activities would occur for approximately 24 to 27 months. Disposal activities could take longer than this depending on the location of disposal sites. The main combustive emission sources from the proposed action would be diesel-fired hydraulic and clamshell dredges, tugboats that assist dredges and transport spoils, spoils hydraulic unloaders, and spoils booster pumps. Disposal activities at wetland and upland sites would also include usage of earth-moving equipment, such as bulldozers, scrapers, compactors, graders, and trucks and trains for spoils transport. Emissions from these equipment at each project site are presented below and in Appendix B.

Project emissions would be spread over much of the Bay Area, since disposal sites are scattered throughout the region and are several miles distant from the Oakland Harbor dredging site. Additionally, since most of the project emission sources would be mobile, pollutant impacts would not be large enough

in a localized area to exceed any ambient air quality standard. However, dredging and disposal emissions would exceed BAAQMD significance thresholds on a daily basis (see sections 4.1.3, 4.1.4, and 6.0).

4.1.2.2 Dust and Odors from Sediments Placed behind Dike Levees and in Drying Ponds

Fugitive dust emissions in the form of PM₁₀ would be generated during site preparation and levee construction at wetland or upland sites where soil conditions are dry. Handling, transportation, and disposal of dredging spoils would generally not produce any fugitive dust, since spoils would be wet. However, dry spoils trucked to disposal sites would be a source of fugitive dust if not properly mitigated. Mitigation measures identified in the following sections would minimize emissions of fugitive dust during project disposal activities.

Odors could be emitted from dredged spoils exposed to the atmosphere due to the decomposition of organic matter. However, it is not expected that project dredging or disposal activities would generate any significant odor impacts. Port staff has made site visits to several different dredged material disposal sites to investigate the possibility of odors associated with the drying process, including drying ponds at Port Sonoma-Marin, San Leandro, and the Port's own drying operations at Berths 30 and 40. On August 8, 1992, several Port staff visited Port Sonoma-Marin to investigate ongoing drying of dredged material from the marina channels and entrance channel. Both recently deposited material and partially dried material were present in Port Sonoma Marin's two drying ponds. No distinct odor was detected, and no odors whatsoever could be detected at the edge of the property. On October 28, 1993, Port staff visited San Leandro's drying ponds during discharge, and could detect no odor associated with the discharge. That discharge is located much closer to residential areas than the Galbraith or Ninth Avenue Terminal sites.

Port staff investigated odor complaints from the placement of sandy Oakland Berth 30 dredged material along Swan Way and near Hegenberger Road in the Airport Business Park. At the Swan Way site, a faint odor of creosote could be detected at the site immediately after initial placement. That odor was associated with pieces of pilings from the railroad trestle, excavated during berth deepening. No odors were detectable after several weeks. Port staff also visited the sites used for initial drying of very fine grained (silts and clays) Berth 30 dredged material. These muds were dried at both Berth 30 and 40. The only odor detected was creosote associated with excavated pilings.

4.1.2.3 Long-Term Air Quality Impacts Resulting from Project Implementation

As a result of the proposed channel deepening, container ships would more easily traverse the Oakland Harbor, thereby reducing queuing times and emissions from this activity during low-tidal stages. Fully loaded ships would be able to call at the Harbor, and the existing fleet would be able to enter and exit fully loaded with reduced tidal restrictions, thus future cargo throughput per ship visit would increase. Fewer ships would be required to transport the same amount of cargo compared to the existing fleet. Fewer emissions would be produced over the long term for a given amount of cargo. The main reasons for this are that a decreased number of ship visits would eliminate a substantial amount of emissions from (1) cargo ships due to cruising and maneuvering activities, (2) tugboats that assist cargo ships within the Harbor, and (3) queuing. The proposed channel deepening would therefore decrease the amount of emissions produced per unit of cargo throughput. This would produce a long-term beneficial impact to air quality in the region.

Project Conformity Analysis

Long-term air quality impacts are also evaluated on the basis of whether project emissions conform to emission growth factors included in the BAAQMD Air Quality, Clean Air, Maintenance, and Attainment Plans (the Plans). As required by the CAA, states establish State Implementation Plans (SIPs) to ensure that areas in attainment of the NAAQS remain in compliance with these standards and that they have a viable plan for nonattainment areas to reach attainment. Section 176 (c) of the CAA, as amended, requires that federal actions conform with the most recent federally approved SIP. Conformity to an implementation plan means that:

1. A project will conform to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards, and
2. A project will not (a) cause or contribute to any new violations of any standard in any area, (b) increase the frequency or severity of any existing standard violation in any area, or (c) delay timely attainment of any standard or any required interim emission reductions or other milestones in any area. The determination of conformity shall be based on the most recent estimates of emissions, as determined by the metropolitan planning organization or other agency authorized to make such estimates.

The EPA finalized a rule governing compliance with Section 176(c) on November 15, 1993 (58 *Federal Register* No. 228). However, the rule includes a grandfather clause. The clause provides that the rule does not apply to proposed actions where (1) an agency has completed all of its NEPA analysis by January 31, 1994 or (2) an agency that initiated its environmental analysis before December 30, 1993 has completed sufficient analysis to perform a conformity determination, and has completed such determination by March 15, 1994. The Oakland Harbor Draft SEIR/S was filed March 18, 1994.

Although the Corps will not complete its NEPA analysis for several months, it did initiate this analysis prior to December 30, 1993, and it has completed the conformity determination on March 15, 1994. Thus, the requirements of the new EPA rule do not apply to the Oakland Harbor project. This interpretation of the grandfather clause has been verified by the EPA Office of Air Quality Planning and Standards. Consequently, the Corps has examined and reviewed the federally approved State Implementation Plan (SIP), the most recently approved Bay Area Air Quality Plan that comprises the San Francisco Bay Area Basin portion of the SIP, and other subsequent related documentation to ensure compliance with Section 176(c) of the CAA.

The conformity analysis should consider whether the project conforms to the guidelines of the most recent federally-approved SIP, as stated in Section 176(c) of the CAA. The San Francisco Bay Area Air Basin (SFBAAB) portion of the SIP most recently approved by the EPA is the 1982 *Bay Area Air Quality Plan* (Air Quality Plan) (Bay Area Air Quality Management District [BAAQMD], Association of Bay Area Governments [ABAG], and the Metropolitan Transportation Commission [MTC] 1982). This plan was required to demonstrate attainment of the O₃ and CO NAAQS by 1987 in the SFBAAB, but ultimately failed to reach its goals. As part of the CAA milestones, the BAAQMD, ABAG, and MTC submitted the following documents on November 15, 1993 to the EPA: (1) the *San Francisco Bay Area Redesignation Request and Maintenance Plan for the National Ozone Standard* (Maintenance Plan), and (2) the *Federal Ozone Nonattainment Area Rate-of-Progress Plan* (Attainment Plan) (BAAQMD, ABAG,

Impacts -- Air Quality

MTC 1993). Since the national O₃ standard has not been exceeded in the SFBAAB more than once annually over the last three years, the BAAQMD believes the region is in attainment of this standard. The Maintenance Plan adopts most of the emission control measures identified in the 1982 SIP, includes new transportation emission control measures, and demonstrates continued attainment of the national O₃ standard in the SFBAAB. The EPA has until May 15, 1995 to approve the Maintenance Plan. If the EPA approves the Maintenance Plan, the Attainment Plan will be withdrawn.

The conformity determination is evaluated on the basis of whether project emissions conform to emission growth factors included in the Air Quality Plan. This plan is the most recent federally-approved SIP for the region. However, the Corps has also chosen to determine project conformity with the Maintenance Plan, since the emission estimates in this plan are 11 years more current and are assumed to be more accurate than the emission inventories in the Air Quality Plan. This approach is consistent with the requirements of Section 176(c) of the CAA. Additionally, the regional planning agencies have implemented the Maintenance Plan, which therefore appears to be an adequate plan for determining conformity.

The navigation improvements provided by the project will alleviate cargo ship traffic congestion during periods of low water in the Oakland Harbor. However, the project dredging and disposal activities would result in significant, short-term increases in air emissions within the project area. These temporary air quality impacts cannot be avoided and are necessary to achieve the long-term air quality benefits of the proposed improvements. Construction impacts would be minimized by feasible and practicable mitigation measures, including the use of clean fuels and injection timing retard on all diesel-powered equipment. Although electrification of the diesel-powered dredge would reduce project emissions, implementation of this measure was deemed infeasible for the following reasons: (1) there are no electric clamshell or self-propelled hopper dredges available, (2) all four electric hydraulic dredges on the West Coast are too large for the project, (3) expensive conversion or retrofits of smaller diesel-powered hydraulic dredges to electrification would increase the frequency of "downtime" during equipment operation, and (4) use of electric dredges would seriously limit competition of dredging contract, increase project costs substantially, and delay project completion. Dredging and disposal emissions would be temporary, intermittent, and would cease on completion of construction activities.

The conformity determination focused on impacts from long-term shipping activities at the Oakland harbor that would occur on completion of project dredging and disposal activities. It is assumed that if the growth in future shipping at the Oakland Harbor would be less than the growth factors assumed for cargo ship emission source categories estimated in the 1982 SIP and Maintenance Plan for the SFBAAB, the project would conform to both plans. These emission categories were chosen for the analysis because they would be future sources most exclusively affected by the project.

Due to the deepening of the navigational channels provided by the project, ships would be able to call at the Oakland Harbor more fully loaded, and future cargo throughput per ship visit would increase. As a result, fewer ships would be required to transport the same amount of cargo compared to the existing fleet and fewer emissions would be produced over the long-term for a given amount of cargo throughput. The main reason for this is that a decreased number of ship visits would eliminate a substantial amount of emissions from cargo ships due to cruising, maneuvering, and queuing activities, and tugboat assistance. To quantify this emissions savings, an analysis was performed that compared ship emissions at the Oakland Harbor for the no project and project scenarios for the years 1997 and 2007.

Upon completion of the project in 1997, the number of ships estimated to visit Oakland Harbor annually under the no project and project scenarios would 1,233, and 1,207, respectively. In the year 2007, the number of annual ship visits for the no project and project scenarios would increase to 1,346 and 1,216, respectively. Taking into consideration longer maneuvering and queuing times for cargo ships and a larger requirement for tugboat assistance under the no project scenario, the project would reduce ship emissions by about 10 to 16 percent, depending on the pollutant, when compared to the no project scenario. For O₃ precursor pollutants, this would correspond to an annual reduction of 1.1 and 17.1 tons of ROG and NO_x, respectively. This is in spite of the estimate that between 1990 and 2000, annual revenue tons at the Oakland Harbor are estimated to increase by a maximum of 5.9 percent, or 0.59 percent per year during this period (see Section 9.0). By the year 2007, implementation of the project would reduce annual ROG and NO_x emissions from ships by 1.9 and 26.3 tons, respectively, compared to the no project scenario.

The Air Quality Plan estimates that emissions from cargo steamships and motorships source categories within the SFBAAB will increase by approximately 23 percent between 1979 and 2000, or an average of 1.1 percent per year. The Maintenance Plan estimates that emissions from ships maneuvering, berthing, and in-transit source categories within the SFBAAB will increase by approximately 30 percent between 1990 and 2010, or an average of 1.5 percent per year. The present analysis shows that the project would reduce emissions from these source categories in future years at the Oakland Harbor. Although emissions from shipping activities at other ports within the SFBAAB could increase, their contributions should keep total shipping emissions within the SFBAAB below the growth factors assumed in both plans, since the Oakland Harbor handles the largest amount of cargo of any port in the SFBAAB. Therefore, it is assumed that the increase in cargo throughput provided by the project at the Oakland Harbor would contribute to less emissions than what is forecasted for future shipping activities in either the Air Quality or Maintenance plans. As a result, the project would conform with the emission growth factors identified in the 1982 SIP and the Maintenance Plan through the year 2007. By definition, in the long-term the project would not (1) cause or contribute to any new ambient air quality standard violation, (2) increase the frequency or severity of any existing standard violation, or (3) delay timely attainment of standard. The project would therefore comply with Section 176(c) of the CAA.

4.1.3 Oakland Harbor

4.1.3.1 Project Impacts

Potential air emission sources of the proposed action include dredges, pipeline booster pumps, grading and trucking equipment, tugboats, and increased rail, truck, and ship traffic. Estimated emissions from dredging equipment are shown in Table 4.1.3.1-1. This table also compares the dredging emissions to the impact significant thresholds discussed in section 4.1.1. As shown in this comparison, the emissions from dredging would be well below 1 percent of total Alameda County emissions. These emissions would be less than significant. However, NO_x emissions would exceed the BACT threshold of 150 pounds per day, which would be significant. There also would be emissions from the tugboats pulling/pushing the disposal cargo in and out of the Harbor. In the context of existing emissions in the Harbor area, these impacts would be considered less than significant. The impacts from tugboat emissions are discussed in more detail under each of the disposal site options below. The area around the Oakland Harbor project area is predominantly industrial; the nearest sensitive receptors are located 1,400 feet from the proposed dredging area. Air emissions from dredging equipment and tugboats would

disperse before reaching this distance; therefore, there is little chance of localized emissions affecting sensitive receptors.

The purpose of the proposed dredging project is for the Port of Oakland to retain existing clients and remain competitive with other western ports by accommodating more fully laden ships and the new generation of larger ships. As stated in section 4.1.2.3, the navigational improvements provided by the project would increase cargo throughput for a given ship visit, compared to existing ship visits at the Port. As a result, cargo ship emissions in future years would decrease, compared to the no action alternative. The project would therefore produce a beneficial air quality impact in the region, as it relates to cargo ship emissions.

Table 4.1.3.1-1. Emissions from Dredging

<i>Pollutant</i>	<i>Dredge Emission Factors (gm/hp-hr)</i>	<i>Dredging Emission Rates (lbs/day)</i>	<i>Dredging Emission Rates (tons/day)</i>	<i>Total Existing Alameda Co. Emissions (tons/day)</i>	<i>Percentage of Alameda County Emissions</i>
Carbon monoxide	4.6	365	0.18	580	0.03
Total organic gases	1.01	80	0.04	320	0.01
Nitrogen oxides	11.01	874	0.44	120	0.36
Sulfur oxides	0.932	74	0.04	16.7	0.22
Particulates	0.902	72	0.04	190	0.02

The additional truck trips that the proposed action would generate from increased cargo throughput is discussed and analyzed in section 4.8. Based on the worst-case, peak-hour traffic levels, regional air emissions were estimated using emission factor data from the ARB. These emissions are presented in Table 4.1.3.1-2. As shown in this table, total daily emissions from increased truck traffic resulting from the proposed project are far less than the significance threshold of total emissions in Alameda County. In reality, most of the miles travelled and the resulting emissions would be through several counties; therefore, the impact within Alameda County would be even less than shown in Table 4.1.3.1-2.

Table 4.1.3.1-2. Emissions from Increased Truck Trips for the Year 2000

<i>Type of Movement</i>	<i>Peak Day Trips</i>	<i>Miles Per Trip</i>	<i>EMISSION FACTORS (g/MILE) ^(a)</i>				<i>EMISSION RATES (TONS/DAY)</i>			
			<i>ROG</i>	<i>CO</i>	<i>NO_x</i>	<i>PM</i>	<i>ROG</i>	<i>CO</i>	<i>NO_x</i>	<i>PM</i>
Local Truck Trips	1,756	175	1.44	6.79	14.18	2.11	0.49	2.30	4.80	0.71
Intermodal Truck Trips	218	13	1.44	6.79	14.18	2.11	0.00	0.02	0.04	0.01
Total (tons/day):							0.49	2.32	4.85	0.72
Alameda Co. Emissions (tons/day) ^(b) :							140	580	120	190
Notes: (a) Emission Factors from EMFAC7F, assuming 100% heavy duty diesel trucks, 55 mph, worst-case between summer and winter rates. (b) Emissions in Alameda County. Source: ARB 1991a.										

Since the additional truck trips have a minimal effect on volume-to-capacity ratios and levels-of-service of affected roadways, as presented in section 4.9, it is not expected that additional trips would cause a significant effect to carbon monoxide levels along affected roadways and the nearest sensitive receptors.

The proposed action may require that existing trains be lengthened, but no new locomotives would be required. The traffic analysis in section 4.9 concluded the rail impacts from the proposed project would cause no substantial traffic delays and that impact would be insignificant. Therefore, air quality impacts from rail traffic are considered less than significant.

4.1.3.2 Mitigation Measures

Since significant NO_x emissions would occur during dredging activities, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. Although electrification of diesel-powered dredges would eliminate a substantial amount of project emissions, this measure was deemed infeasible due to the high incidence of mechanical failures. Additionally, phasing of dredging activities, which would spread project emissions over a longer period and decrease daily emissions, was also deemed infeasible. The most feasible measure to reduce project NO_x emissions would be to retard injection timing of diesel-powered dredges by two degrees. This measure would reduce NO_x emissions by about 15 percent from this equipment (Southwest Research Institute 1991). Although retarding injection timing by more than two degrees would further reduce NO_x emissions, it was not considered (due to fuel economy penalties). Implementation of this measure would reduce NO_x emissions from dredging, but not to insignificance.

4.1.4 Disposal Site Options

4.1.4.1 Ocean Section 102

Project Impacts

Disposal of dredging spoils at Ocean Section 102 would take approximately two years to complete. The sources of emissions from this activity mainly would be diesel-fired tugboats that transport spoils and barge equipment. Summaries of daily and total emissions that would occur from this activity are provided in tables 4.1.4.1-1 and 4.1.4.1-2, respectively. Total emissions are based on disposal of 5.4 mcy. Project emissions would occur in Alameda and San Francisco counties. As shown in Table 4.1.4.1-1, project emissions would exceed the daily BACT trigger levels for all pollutants except CO. These emissions would therefore be significant.

Project emissions would be spread over a large portion of the Bay Area region, between the Oakland Harbor and offshore waters. Additionally, since project emission sources would be mobile, pollutant impacts would not be large enough in a localized area to exceed any ambient air quality standard.

Mitigation Measures

Since disposal activities would exceed BAAQMD emission significance thresholds, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. The most feasible measures to reduce significant project emissions would be to (1) retard injection timing of diesel-powered equipment for NO_x control and (2) use reformulated diesel fuel to reduce TOG/ROG and SO₂. Retarding

injection timing by two degrees would reduce NO_x emissions by about 15 percent from diesel-powered equipment. Although retarding injection timing by more than 2 degrees would further reduce NO_x emissions, it was not considered due to fuel economy penalties. Use of reformulated fuel would reduce TOG/ROG and SO₂ emissions by 15 and 95 percent, respectively, from diesel-powered equipment (Southwest Research Institute 1991).

Table 4.1.4.1-1 shows the reduction in project emissions due to the implementation of 2 degree injection timing retard and reformulated diesel fuel. These data show that these mitigation measures would reduce project SO₂ emissions to insignificant. However, NO_x and TOG/ROG emissions would remain significant.

4.1.4.2 Alcatraz

Project Impacts

Disposal of dredging spoils at Alcatraz would take approximately two years to complete. The sources of emissions from this activity mainly would be diesel-fired tug boats that transport spoils and barge equipment. Summaries of daily and total emissions that would occur from this activity are provided in tables 4.1.4.2-1 and 4.1.4.2-2, respectively. Total emissions are based on a disposal rate of 4.8 mcy. Project emissions would occur in Alameda and San Francisco counties. As shown in Table 4.1.4.2-1, daily project emissions would not exceed 1 percent of the combined emissions from these two counties. However, project NO_x emissions would exceed the daily BACT trigger levels.

Project emissions would be spread over a large area, between the Oakland Harbor and Alcatraz Island. Additionally, since project emission sources would be mobile, pollutant impacts would not be large enough in a localized area to exceed any ambient air quality standard.

Mitigation Measures

Since significant NO_x emissions would occur during disposal activities, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. The NO_x mitigation measures identified in section 4.1.4.1 would also apply to disposal activities at Alcatraz. Table 4.1.4.2-1 shows the reduction in project NO_x emissions due to the implementation of 2 degree injection timing retard. These data show that this mitigation measure would reduce project NO_x emissions, but not to insignificance.

4.1.4.3 Bay Farm Borrow Area

Project Impacts

Disposal of dredging spoils at the Bay Farm Borrow Area would take approximately 1.5 years to complete. The sources of emissions from this activity mainly would be diesel-fired tug boats that transport spoils and barge equipment. Summaries of daily and total emissions that would occur from this activity are provided in tables 4.1.4.3-1 and 4.1.4.3-2, respectively. Total emissions are based on a disposal rate of 6.6 mcy. Project emissions would occur in Alameda County. As shown in Table 4.1.4.3-1, daily project emissions would not exceed 1 percent of the combined emissions from this

Table 4.1.4.1-1. Daily Emissions for Disposal at Ocean Section 102.

<i>Activity/ Equipment Type</i>	<i>Pounds Per Day</i>						
	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>PM</i>	<i>PM10</i>
Clamshell Sediments							
Tug Boat	224.0	215.0	334.0	1,997.0	139.7	161.7	155.2
Crew Boat	2.9	2.8	4.4	25.6	1.8	2.1	2.0
Barge Equipment	10.6	10.2	28.8	132.3	8.8	9.5	9.1
Pick-up Truck	1.0	1.0	11.5	1.2	0.1	0.2	0.2
Total Pounds/Day	238.5	228.9	378.7	2,156.1	150.4	173.4	166.4
Total Tons/Day	0.12	0.11	0.19	1.08	0.08	0.09	0.08
Pounds/Day - Mitigated	202.7	194.6	378.7	1,832.7	7.5	173.4	166.4
Tons/Day - Mitigated	0.10	0.10	0.19	0.92	0.00	0.09	0.08
Alameda/SF Cos. Tons/Day	381	188	790	164	26.5	266	141

Table 4.1.4.1-2. Total Emissions for Disposal at Ocean Section 102.

<i>Activity/ Equipment Type</i>	<i>Total Tons</i>						
	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>PM</i>	<i>PM10</i>
Clamshell Sediments							
Tug Boat	75.6	72.6	116.1	674.0	47.1	54.6	52.4
Crew Boat	1.0	0.9	1.5	8.6	0.6	0.7	0.7
Barge Equipment	3.6	3.4	9.7	44.7	3.0	3.2	3.1
Pick-up Truck	0.3	0.3	3.9	0.4	0.0	0.1	0.1
Total	80.5	77.2	131.2	727.7	50.7	58.6	56.3
Mitigated Emissions	68.4	65.6	131.2	618.5	2.5	58.6	56.3

Pollutant abbreviations: total organic compounds (TOG), reactive organic compounds (ROG), carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), particulate matter (PM), particulate matter less than 10 microns in diameter (PM10).

Table 4.1.4.2-1. Daily Emissions for Disposal at Alcatraz.

<i>Activity/ Equipment Type</i>	<i>Pounds Per Day</i>						
	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>PM</i>	<i>PM10</i>
Clamshell Sediments							
Tug Boat	40.7	39.1	62.5	363.1	25.4	29.4	28.2
Crew Boat	2.9	2.8	4.4	25.6	1.8	2.1	2.0
Barge Equipment	2.6	2.5	7.2	33.1	2.2	2.4	2.3
Pick-up Truck	1.0	1.0	11.5	1.2	0.1	0.2	0.2
Total Pounds/Day	47.2	45.3	85.7	423.0	29.5	34.0	32.6
Total Tons/Day	0.02	0.02	0.04	0.21	0.01	0.02	0.02
Pounds/Day - Mitigated	47.2	45.3	85.7	359.5	1.5	34.0	32.6
Tons/Day - Mitigated	0.02	0.02	0.04	0.18	0.00	0.02	0.02
Alameda/SF Cos. Tons/Day	381	188	790	164	26.5	266	141

Table 4.1.4.2-2. Total Emissions for Disposal at Alcatraz.

<i>Activity/ Equipment Type</i>	<i>Total Tons</i>						
	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>PM</i>	<i>PM10</i>
Clamshell Sediments							
Tug Boat	23.1	22.2	35.5	206.1	14.4	16.7	16.0
Crew Boat	1.6	1.5	2.5	14.5	1.0	1.2	1.1
Barge Equipment	1.5	1.4	4.0	18.4	1.2	1.3	1.2
Pick-up Truck	0.6	0.5	6.5	0.7	0.1	0.1	0.1
Total	26.8	25.6	48.5	239.7	16.7	19.3	18.4
Mitigated Emissions	26.8	25.6	48.5	203.7	16.7	19.3	18.4

Table 4.1.4.3-1. Daily Emissions for Disposal at Bay Farm Borrow Area.

<i>Activity/ Equipment Type</i>	<i>Pounds Per Day</i>						
	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>PM</i>	<i>PM10</i>
Hydraulic Sediments							
Tug Boat	122.2	117.3	187.6	1,089.2	76.2	88.2	84.7
Crew Boat	2.9	2.8	4.4	25.6	1.8	2.1	2.0
Barge Equipment	10.6	10.2	28.8	132.3	8.8	9.5	9.1
Pick-up Truck	1.0	1.0	11.5	1.2	0.1	0.2	0.2
Clamshell Sediments							
Tug Boat	81.4	78.2	125.1	726.2	50.8	58.8	56.5
Crew Boat	2.9	2.8	4.4	25.6	1.8	2.1	2.0
Barge Equipment	7.9	7.6	21.6	99.2	6.6	7.1	6.8
Pick-up Truck	1.0	1.0	11.5	1.2	0.1	0.2	0.2
Total Pounds/Day	229.9	220.6	394.9	2,100.6	146.2	168.0	161.3
Total Tons/Day	0.11	0.11	0.20	1.05	0.07	0.08	0.08
Pounds/Day - Mitigated	195.4	187.5	394.9	1,785.51	7.3	168.0	161.3
Tons/Day - Mitigated	0.10	0.09	0.20	0.89	0.00	0.08	0.08
Alameda County Tons/Day	320	140	580	120	17	190	100

Table 4.1.4.3-2. Total Emissions for Disposal at Bay Farm Borrow Area.

<i>Activity/ Equipment Type</i>	<i>Total Tons</i>						
	<i>TOG</i>	<i>ROG</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>PM</i>	<i>PM10</i>
Hydraulic Sediments							
Tug Boat	8.9	8.5	13.6	79.0	5.5	6.4	6.1
Crew Boat	0.2	0.2	0.3	1.7	0.1	0.1	0.1
Barge Equipment	0.7	0.7	1.9	8.6	0.6	0.6	0.6
Pick-up Truck	0.1	0.1	0.8	0.1	0.0	0.0	0.0
Clamshell Sediments							
Tug Boat	24.1	23.1	37.0	214.8	15.0	17.4	16.7
Crew Boat	0.8	0.8	1.3	7.4	0.5	0.6	0.6
Barge Equipment	2.3	2.2	6.2	28.6	1.9	2.0	1.9
Pick-up Truck	0.3	0.3	3.4	0.4	0.0	0.0	0.0
Total	37.3	35.8	64.5	340.6	23.6	27.2	26.1
Mitigated Emissions	31.7	30.4	64.5	289.5	1.2	27.2	26.1

county. However, project emissions would exceed the daily BACT trigger levels for all pollutants except CO and SO₂. Emissions of ROG, NO_x, and PM₁₀ would therefore be significant.

Project emissions would be spread over a large area, between the Oakland Harbor and the Bay Farm Borrow Area. Additionally, since project emission sources would be mobile, pollutant impacts would not be large enough in a localized area to exceed any ambient air quality standard.

Mitigation Measures

Since project emissions from disposal activities would exceed daily BAAQMD significance thresholds for all pollutants except SO₂, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. The mitigation measures identified in section 4.1.4.1 would also apply to disposal activities at Bay Farm Borrow Area. Table 4.1.4.3-1 shows the reduction in project TOG/ROG and NO_x emissions due to the implementation of 2 degree injection timing and reformulated diesel fuel. These data show that these mitigation measures would reduce project TOG/ROG and NO_x emissions, but not to insignificance.

4.1.4.4 Leonard Ranch/Redwood Landfill

Project Impacts

EMISSIONS FROM UNLOADER, PUMPS, AND CONSTRUCTION EQUIPMENT. Air pollutant emissions sources associated with the Leonard Ranch disposal alternative include unloader, pumps, and construction equipment used for preparing the site and constructing and compacting containment levees and interior dikes or other site features.

Estimated emissions from these equipment for this disposal alternative are shown in Table 4.1.4.4-1. The emission factors and assumptions used in these estimations are also shown in this table.

EMISSIONS FROM TRUCKS TRANSPORTING MATERIAL TO REDWOOD LANDFILL. Truck exhaust would be emitted during transport of dried sediment to the Redwood Landfill. Estimated emissions from the transport trucks for the Leonard Ranch disposal alternative are shown in Table 4.1.4.4-1. The emissions factors and assumptions used in these estimations are also shown in this table. The transport truck emissions would be dispersed along the routes in Marin and Sonoma counties. Table 4.1.4.4-1 shows that the estimated emissions would be less than the significance threshold of 1 percent of total Sonoma County and Marin County emissions. However, NO_x emissions would exceed the BACT threshold of 150 pounds per day. These emissions would therefore be significant.

EMISSIONS FROM FUGITIVE DUST SOURCES. Fugitive dust sources include movement of soil during levee construction and site preparation, movement of dried sediments behind dike levees, and transport by truck of dried sediments.

Because of the relatively large site size, the large amount of soil to be moved around to construct the containment levees and interior dikes, the large amount of exposed soil, and the relatively high winds in the area, the potential for fugitive dust generation is high. All material would be moist and probably not create a fugitive dust problem. Incorporation of appropriate mitigation measures, such as regularly

applying a soil binding agent (e.g., water) during construction or when large areas of bare soil are exposed if soil is dry, should reduce this impact to insignificant.

**Table 4.1.4.4-1. Emissions from Unloader, Pumps, and Construction Equipment
Leonard Ranch/Redwood Landfill Disposal Alternative
Port of Oakland, California**

<i>Emission Source</i>	<i>Daily Throughput (hp-hr)</i>	EMISSION FACTORS			EMISSION RATES (TONS/DAY)		
		<i>CO</i>	<i>TOG</i>	<i>NO_x</i>	<i>CO</i>	<i>TOG</i>	<i>NO_x</i>
		<i>(g/hp-hr) ^(d)</i>					
Hydraulic Unloader ^(a)	13,920	3.03	1.14	14	0.05	0.02	0.21
Drainage Pumps (2) ^(b)	792	3.03	1.14	14	0.00	0.00	0.01
Booster Pumps (2) ^(c)	12,800	3.03	1.14	14	0.04	0.02	0.20
Scrapers (4) ^(e)	2,880	2.45	0.55	7.46	0.008	0.002	0.024
Crawler Tractor Dozers (2) ^(e)	1,188	2.15	0.75	7.81	0.003	0.001	0.010
Tractor/Sheepsfoot Roller (1) ^(e)	594	2.15	0.75	7.81	0.001	0.000	0.005
Water Truck (1) ^(e)	540	2.28	0.37	8.15	0.001	0.000	0.005
Grader (1) ^(e)	720	1.54	0.36	7.14	0.001	0.000	0.006
	<i>miles</i>	<i>(grams/mile)</i>					
Haul Trucks ^(f)	3,264	6.71	1.65	14.20	0.024	0.006	0.051
				Total:	0.13	0.05	0.47
		Existing Total Sonoma County Emissions ^(g) :			183	199	31
		Existing Total Marin County Emissions ^(g) :			120	75	19

Notes:

- (a) Assumes 1,740 average hp used, 8 hrs/day.
 (b) Assumes 66 average hp used for both pumps, 12 hrs/day.
 (c) Assumes two pumps used 8 hrs/day, 800 hp each.
 (d) Emission factors for unloader and pump from Table 3.3-1, AP-42, Vol. 1 (EPA, 1992); emission factors for construction equipment from Table II-7.1 of AP-42, Vol. 2 (EPA, 1985).
 (e) Construction equipment assumed to operate at 60 percent load, 6 hours per day, and the following hp: scrapers, 200 hp; dozers, 165 hp; roller, 165 hp; water truck, 150 hp; grader 200 hp.
 (f) Emission factors from EMFACSCF (California Air Resources Board, 1993), assuming 1995 fleet, 100 percent heavy duty diesel trucks, average 50 miles per hour.
 (g) Source: ARB 1991a.

Potential for airborne particles to be blown from sediment placed on and moved around the site would be low because the sediment would be wet and have a high clay content, which reduces potential for wind erosion.

Because of the clayey nature of the dried sediment and its unknown moisture content at the time of transport to Redwood Landfill, quantification of the particulate emissions and concentrations is not possible. If, after sediment moving begins, significant amounts of dust appear to be generated, a soil binding agent such as water could be applied to the surface of the sediment piles before further moving. Sediments would be relatively moist when transported and would therefore not create a significant dust problem. Trucks should be covered with tarpaulins or protected by an equivalent method if dust appears to be generated during transport of dried sediment.

Mitigation Measures

Since project emissions would exceed the BAAQMD NO_x significance threshold during disposal activities, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance.

Impacts -- Air Quality

Implementation of 2-degree injection timing retard on diesel-powered equipment would reduce NO_x emissions from these equipment by 15 percent. Implementation of this measure, however, would not reduce NO_x emissions from this disposal option to insignificance. Additional mitigation measures that would reduce the air quality burden of the project and reduce the potential for nuisance from project emission sources include the following:

- Obtain and comply with all required BAAQMD permits and applicable rules and regulations.
- Avoid unnecessary idling of construction equipment and transport trucks.
- Keep all trucks properly tuned and maintained.

The following mitigation measures may be required to reduce fugitive dust impacts to insignificance:

- Apply a soil binding agent such as water as needed during construction or when there are large areas of bare, exposed soil.
- Apply a soil binding agent such as water to the surface of the sediment piles as needed prior to moving and placing in trucks.
- Cover trucks with tarpaulins or protect them by an equivalent method to prevent generation of dust during transport of dried sediment, as needed.

4.1.4.5 Sonoma Baylands

Project Impacts

EMISSIONS FROM UNLOADER, PUMPS, AND CONSTRUCTION EQUIPMENT. Air pollutant emissions sources associated with this disposal alternative include construction equipment used for upgrading existing perimeter levees and building a series of interior peninsulas and equipment used for dredged material unloading and slurry pumping.

Estimated emissions from the worst-case scenario (four cranes and two dozers operating on a single day) for the Sonoma Baylands disposal alternative are shown in Table 4.1.4.5-1. The emission factors and assumptions used in these estimations are also shown in this table. These data show that daily project NO_x emissions would exceed 1 percent of total Sonoma County emissions and the BAAQMD significance threshold of 150 pounds. Therefore, the temporary impacts associated with the NO_x emissions from the unloader, pumps, and construction equipment used for this alternative would be significant.

EMISSIONS FROM FUGITIVE DUST SOURCES. Potential sources of fugitive dust include movement of soil during levee construction and site preparation and possibly exposed soil on levees after placement of dredged sediment. The dredged materials will be wet when placed on the site and kept wet by tidal waters, thereby posing no fugitive dust problems.

Because large amounts of soil will be moved to construct the containment levees and interior peninsulas, a large amount of soil may be exposed at one time; combined with the relatively high winds in the area,

the potential for fugitive dust generation is high. Incorporation of appropriate mitigation measures, such as regularly applying a soil binding agent (e.g., water) when large areas of bare and dry soil are exposed, will reduce this potential impact to insignificance.

Table 4.1.4.5-1. Emissions from Unloader, Pumps, and Construction Equipment for the Sonoma Baylands Disposal Alternative

<i>Emission Source</i>	<i>Daily Throughput (hp-hr)</i>	<i>EMISSION FACTORS (G/HP-HR) ^(b)</i>			<i>EMISSION RATES (TONS/DAY)</i>		
		<i>CO</i>	<i>TOG</i>	<i>NO_x</i>	<i>CO</i>	<i>TOG</i>	<i>NO_x</i>
Hydraulic Unloader ^(a)	27,840	3.03	1.14	14	0.09	0.03	0.43
Drainage Pump ^(b)	960	3.03	1.14	14	0.00	0.00	0.01
Booster Pumps (2) ^(c)	12,800	3.03	1.14	14	0.04	0.02	0.20
D-6 Tractor Dozers (2) ^(e)	1,188	2.15	0.75	7.81	0.004	0.001	0.014
Cranes (4) ^(e)	4,032	2.15	0.75	7.81	0.010	0.003	0.035
		Total:			0.14	0.05	0.69
Existing Total Sonoma County Emissions ^(f):					183	199	31

Notes:

- (a) Assumes 1,740 average hp used, 16 hrs/day.
- (b) Assumes 60 average hp used, 16 hrs/day.
- (c) Assumes two pumps used 8 hrs/day, 800 hp each.
- (d) Emission factors for unloader and pump from Table 3.3-1, AP-42, Vol. 1 (EPA 1992c); emission factors for construction equipment from Table II-7.1 of AP-42, Vol. 2 (EPA 1985).
- (e) Construction equipment assumed to operate at 60 percent load, 10 hours per day, and the following hp: dozers, 165 hp; cranes, 168 hp.
- (f) Source: ARB 1991a.

Potential for airborne particles to be blown from levees and interior peninsulas and from sediment placed on the site would be low. Soil on levees and peninsulas would be compacted and covered with upland/transitional vegetation. The dredged sediment would be wet and eventually be covered with marsh vegetation.

Mitigation Measures

Since project emissions would exceed the BAAQMD NO_x significance threshold during disposal activities, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. Implementation of two degree injection timing retard on diesel-powered equipment would reduce NO_x emissions from these equipment by 15 percent. Implementation of this measure, however, would not reduce NO_x emissions from the alternative to insignificance. Additional mitigation measures that would reduce the air quality burden of the project and reduce the potential for nuisance creation by project emission sources include the following:

- Obtain and comply with all required BAAQMD permits and applicable rules and regulations.
- Avoid unnecessary idling of construction equipment and transport trucks.
- Keep all trucks and other construction equipment properly tuned and maintained.

The following mitigation measure is required to reduce fugitive dust impacts to insignificance:

- Applying a soil binding agent such as water during construction of levees and when there are large areas of bare, exposed soil, as needed.

4.1.4.6 Galbraith Golf Course

Project Impacts

EMISSIONS FROM TUGBOATS, UNLOADING, AND CONSTRUCTION EQUIPMENT. Air pollutant emissions sources associated with this disposal alternative include tugboat engines, unloaders, a booster pump, and construction equipment used for site preparation, site feature (e.g., dike and levee) construction and compaction, and crust management. Construction equipment that would be used during the crust management program includes either one dragline (an excavator) or one tractor (probably only one would be operating at any one time on a single day). Emissions from this equipment are represented by emissions shown for the tractor on Table 4.1.4.6-1.

Estimated emissions from the tugboats, unloaders, construction equipment, and pumps for the Galbraith Golf Course disposal alternative are shown in Table 4.1.4.6-1. The emission factors and assumptions used for estimating these emissions are also shown in this table. Comparing the total emissions associated with this alternative to total Alameda County emissions shows that emissions from the proposed project are less than the significance threshold of 1 percent of total county emissions. However, TOG and NO_x emissions would exceed the BACT thresholds of 150 pounds per day. These emissions would therefore be significant.

EMISSIONS FROM TRUCKS TRANSPORTING LEVEE MATERIAL TO THE SITE. Approximately 228,000 cubic yards of levee material would need to be imported to the site. It is assumed that all of this material would be imported from commercial sources in the region, although some may be extracted from on site. Material coming from commercial sources would access the site via I-880, Hegenberger Drive, Airport Road, and Doolittle Drive. As discussed in section 4.8.4.6, trucking the material would generate up to approximately 185 round trips per day or about 20 round trips per hour over a period of approximately 4 months. Because of the relatively low number of trucks compared to the existing number of trucks and other vehicles on affected routes, and because of the temporary nature of transporting the material, it is expected that the air quality impact from emissions from these trucks would be insignificant.

EMISSIONS FROM SEDIMENT AND FUGITIVE DUST SOURCES. Fugitive dust sources include emissions during movement of soil during levee construction and site preparation and from grading dried sediments placed behind dike levee.

Due to the relatively large size (surface area) of the site, the amount of soil that would be moved around to construct the containment levees and interior dikes, and the amount of exposed soil, there is potential for significant dust generation. Incorporation of appropriate mitigation measures, such as regularly applying a soil binding agent such as water during construction to dry exposed soil, should reduce this impact to insignificance. Trucks should also be covered as needed with tarpaulins or an equivalent method so that dust would not be generated during transport of the levee material to the site.

**Table 4.1.4.6-1. Emissions from Tugboats, Unloading, and Construction
for the Galbraith Golf Course Disposal Alternative**

<i>Emission Source</i>	<i>Daily Throughput (1,000 gal/day)</i>	<i>EMISSION FACTORS</i>			<i>EMISSION RATES (TONS/DAY)</i>		
		<i>CO</i>	<i>TOG (lb/1,000 gal)^(e)</i>	<i>NO_x</i>	<i>CO</i>	<i>TOG</i>	<i>NO_x</i>
Towing Tugs ^(a)	3.4	41.4	32.8	339.6	0.07	0.06	0.58
Tender Tug ^(b)	0.22	80.9	17.1	360.0	0.01	0.00	0.04
	<i>(hp-hr)</i>		<i>(g/hp-hr) ^(f)</i>				
Hydraulic Unloader ^(c)	13,920	3.03	1.14	14	0.05	0.02	0.21
Shore Booster Pump ^(d)	6,400	3.03	1.14	14	0.02	0.01	0.10
Scrapers (4) ^(g)	2,880	2.45	0.55	7.46	0.008	0.002	0.024
Crawler Tractor Dozers (2) ^(g)	1,188	2.15	0.75	7.81	0.003	0.001	0.010
Tractor (1) ^(g)	594	2.15	0.75	7.81	0.001	0.000	0.005
Water Truck (1) ^(g)	540	2.28	0.37	8.15	0.001	0.000	0.005
Grader (1) ^(g)	720	1.54	0.36	7.14	0.001	0.000	0.006
Total:					0.16	0.09	0.98
Existing Total Alameda County Emissions ^(h) :					580	320	120

- Notes:
- (a) Assumes 3,000 rated hp towing tug; 22 hours/day; fuel consumption rate of 0.06 gal/hp-hr; 102,357 gallons/month.
 - (b) Assumes 800 rated hp tug; 16 hours/day; fuel consumption rate of 0.06 gal/hp-hr; 432 gallons per month.
 - (c) Assumes 1,740 average hp used, 8 hrs/day.
 - (d) Assumes 800 average hp used, 8 hrs/day.
 - (e) Emission factors from Table II-3.3, AP-42, Vol. 2 (EPA 1985) for 3,600 hp vessel for towing tug, 800 hp vessel for tender tug, both cruise mode.
 - (f) Emission factors for unloader and pump from Table 3.3-1, AP-42, Vol. 1 (EPA 1992c); emission factors for construction equipment from Table II-7.1 of AP-42, Vol. 2 (EPA 1985).
 - (g) Construction equipment assumed to operate at 60 percent load, 6 hours per day, and the following hp: scrapers, 200 hp; dozers, 165 hp; roller, 165 hp; water truck, 150 hp; grader, 200 hp.
 - (h) Source: ARB 1991a.

There would be low potential for airborne particles to be blown from sediments placed on and moved around on the site (as during the crust management program) because the sediments would be kept wet or moist at all times and have a high clay content, which reduces potential for wind erosion.

The sediment that would be placed at the site contains sulfides, petroleum hydrocarbons, and other organic compounds that have the potential to generate odors. However, it is not expected that there will be a significant odor problem with sediment placed at the Galbraith site because there is a relatively low percentage (approximately 1 percent) of total organic compounds in the sediment; any odor would likely be dissipated by the time it reaches off-site receptors, and the site is surrounded primarily by industrial land (including a wastewater treatment plant). If significant odor problems are detected, and clearly related to drying of dredged material and not operation of the wastewater treatment plant, the contractor operating the drying facility will minimize the generation of odor by reducing the frequency of ditching operations that could generate odors.

A characterization of the impact from exposure of these contaminants within fugitive dust to the public is contained in the California Public Health and Safety Code, Section 4.9.

Project emissions would exceed BAAQMD significance thresholds for TOG and NO_x. Mitigation measures identified in Section 4.1.4.1 were evaluated to determine if they could reduce project emissions to insignificance. Implementation of injection timing retard and use of reformulated fuel on diesel-powered equipment would reduce TOG and NO_x emissions, but not to insignificance.

Mitigation Measures

The following mitigation measures shall be required to reduce fugitive dust impacts to insignificant:

- When necessary, apply a soil binding agent such as water during construction or when there are large areas of bare, exposed soil.
- When necessary, trucks should be covered with tarpaulins or an equivalent method so that dust would not be generated during transport of soil.

4.1.4.7 Port/Landfill

Project Impacts

Engine exhaust emission sources that would be associated with this option include tugboats, barge equipment, a clamshell dredge unloading the barges, on-site construction equipment for site preparation and dike construction, an excavator to load dried sediment into trucks or rail cars, and trucks or trains transporting dried sediment to a landfill. Fugitive dust sources associated with this option include exposed drying sediment, loading of dried sediment into trucks/rail cars, and transport of dried sediment to a landfill site. On-site construction equipment would likely include loaders and compactors, with no more than about four pieces of equipment operating at any one time. As stated in section 4.8.4.7, the approximately 96 round-trip truck trips per day required for transport of dried sediment (assuming three drying cycles) to either the West Contra Costa Sanitary Landfill (Richmond) or the BFI Vasco Road Sanitary Landfill (Livermore) would make an insignificant addition to the volumes along any of the routes used. As stated in section 4.8.4.7, if the rail option were selected, approximately three to four trains per

month would be generated. Daily emissions that would occur from activities at the Port/Landfill are presented in 4.1.4.7-1. These data show that project emissions would exceed the daily BAAQMD emission thresholds for TOG and NO_x. These emissions would therefore be significant.

Significant fugitive dust emissions could be generated if the sediment dries completely and no measures are taken to control generation of dust. However, about a month after its placement at the Ninth Avenue Terminal, the sediment will be excavated and transported away from the site. After one month of drying, the sediment will likely still be sufficiently moist so that fugitive dust would not be generated. Therefore, no impacts are expected from dust generated during drying at the Ninth Avenue Terminal, loading of this sediment into trucks or rail cars, and from transport of material to a disposal site.

Mitigation Measures

Since disposal activities at the Port/Landfill would exceed BAAQMD significance thresholds for TOG and NO_x, the mitigation measures identified in section 4.1.4.1 would also apply at this location. Although implementation of injection timing retard and reformulated diesel fuel would reduce TOG and NO_x emissions at this location, these emissions would remain significant.

4.1.4.8 Montezuma Wetlands

Project Impacts

The sources of emissions that are associated with the disposal of dredging spoils at the Montezuma Wetlands mainly would be diesel-fired tug boats that transport spoils, a hydraulic dredge for spoils pump-out, and barge equipment. Site preparation and land-based handling of spoils would also include usage of earth-moving equipment, such as bulldozers, compactors, and graders. Summaries of daily and total emissions that would occur from this activity are provided in Tables 4.1.4.8-1 and 4.1.4.8-2, respectively. Total emissions are based on a disposal rate of 6.4 mcy. Project emissions would occur in Alameda, Contra Costa, and Solano counties. As shown in Table 4.1.4.8-1, daily project emissions would not exceed one percent of the combined emissions from these counties. However, project emissions would exceed the daily BACT trigger levels for all pollutants. These emissions would therefore be significant. Fugitive dust emissions in the form of PM₁₀ would be generated during site preparation and land-based handling of spoils when soil conditions are dry. These emissions would occur at a rate of 0.6 tons per acre-month (EPA 1985). Data presently are not available to determine the level of fugitive dust emissions that would occur from this site. However, fugitive dust emissions from dredging spoils would generally not occur, since spoils would be wet.

Project emissions would be spread over a large portion of the Bay Area region, between the Oakland Harbor and Montezuma Wetlands. Additionally, since project emission sources would be mobile, pollutant impacts would not be large enough in a localized area to exceed any ambient air quality standard.

Mitigation Measures

Since project emissions would exceed BAAQMD significance thresholds during disposal activities, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. The mitigation measures identified in section 4.1.4.1 would also apply to disposal activities at the

**Table 4.1.4.7-1. Emissions from Unloader, Pumps, and Construction Equipment
for the Port/Landfill Disposal Alternative**

Emission Source	Daily Throughput (1,000 gal/day)	EMISSION FACTORS			EMISSION RATES (TONS/DAY)		
		CO	TOG (lb/1,000 gal) ^(e)	NO _x	CO	TOG	NO _x
Tug Boat ^(a)	0.951	70.2	45.7	407.5	0.03	0.02	0.19
Crew Boat ^(b)	0.269	70.2	45.7	407.5	0.01	0.01	0.05
Barge Equipment ^(c)	0.075	102.0	37.5	469.0	0.00	0.00	0.02
	(hp-hr/day)		(g/hp-hr) ^(f)				
Hydraulic Unloader ^(j)	34,800	3.03	1.14	14	0.12	0.04	0.54
Scraper ^(d)	720	2.45	0.55	7.46	0.002	0.000	0.006
Crawler Tractor Dozer ^(d)	594	2.15	0.75	7.81	0.001	0.000	0.005
Tractor/Sheepsfoot Roller ^(d)	594	2.15	0.75	7.81	0.001	0.000	0.005
Water Truck ^(d)	540	2.28	0.37	8.15	0.001	0.000	0.005
Grader ^(d)	720	1.54	0.36	7.14	0.001	0.000	0.006
	(miles/day)		(grams/mile) ^(g)				
Haul Trucks ^(h)	6,912	6.79	1.48	14.18	0.052	0.011	0.108
Total:					0.22	0.09	0.94
Existing Total Alameda County Emissions ⁽ⁱ⁾ :					580	320	120
Project Percent of Existing Alameda County Emissions (%):					0.04	0.03	0.78

- Notes:**
- (a) Assumes 1,200 rated hp; operating at 50 percent load; 24 hours/day; fuel consumption rate of 39.6 gal/hp-hr.
 - (b) Assumes 340 rated hp; operating at 50 percent load; 24 hours/day; fuel consumption rate of 11.2 gal/hp-hr.
 - (c) Assumes 95 rated hp; operating at 50 percent load; 24 hrs/day.
 - (d) Construction equipment assumed to operate at 60 percent load, 6 hours per day, and the following hp: scrapers, 200 hp; dozers, 165 hp; roller, 165 hp; water truck, 150 hp; grader, 200 hp.
 - (e) Emission factors from Table II-3.3, AP-42, Vol. 2 (EPA 1985).
 - (f) Emission factors from Table II-7.1 of AP-42, Vol.2 (EPA 1985).
 - (g) Emission factors from EMFAC7 (California Air Resources Board 1993), assuming 1995 fleet, 100 percent heavy-duty diesel trucks, average speed 55 miles per hour.
 - (h) Assumes 96 roundtrips at 72 miles per roundtrip (assuming Vasco Road Landfill).
 - (i) Source: ARB 1991a.
 - (j) Assumes 1,740 average hp used, 20 hrs/day.

Table 4.1.4.8-1. Daily Emissions for Disposal at Montezuma Wetlands.

Activity/ Equipment Type	Pounds Per Day						
	TOG	ROG	CO	NOx	SO2	PM	PM10
Hydraulic Sediments							
Tug Boat	203.6	195.4	312.7	1,815.4	127.0	147.0	141.1
Crew Boat	2.9	2.8	4.4	25.6	1.8	2.1	2.0
Barge Equipment	15.9	15.2	43.2	198.5	13.2	14.2	13.6
Pick-up Truck	1.0	1.0	11.5	1.2	0.1	0.2	0.2
Clamshell Sediments							
Tug Boat	81.4	78.2	125.1	726.2	50.8	58.8	56.5
Crew Boat	2.9	2.8	4.4	25.6	1.8	2.1	2.0
Barge Equipment	7.9	7.6	21.6	99.2	6.6	7.1	6.8
Pick-up Truck	1.0	1.0	11.5	1.2	0.1	0.2	0.2
Spoils Pump-out							
Hydraulic Dredge	31.2	29.9	84.8	390.0	25.9	27.9	26.7
Tug Boat	13.6	13.0	20.8	121.0	8.5	9.8	9.4
Generator	1.9	1.8	5.2	24.0	1.6	1.7	1.6
Launch	61.3	58.8	183.8	0.4	0.4	0.0	0.0
Spoils Handling							
Land-Based Equipment	18.2	17.5	154.3	225.6	22.7	18.8	18.0
Total Pounds/Day	442.7	425.0	983.4	3,654.0	260.4	289.7	278.1
Total Tons/Day	0.22	0.21	0.49	1.83	0.13	0.14	0.14
Pounds/Day - Mitigated	376.3	361.3	983.4	3,105.9	13.0	289.7	278.1
Tons/Day - Mitigated	0.19	0.18	0.49	1.55	0.01	0.14	0.14
Ala/CC/Sol Cos. Tons/Day	693	322	1,153	307	84.4	356	243

Table 4.1.4.8-2. Total Emissions for Disposal at Montezuma Wetlands.

Activity/ Equipment Type	Total Tons						
	TOG	ROG	CO	NOx	SO2	PM	PM10
Hydraulic Sediments							
Tug Boat	41.5	39.9	63.8	370.3	25.9	30.0	28.8
Crew Boat	0.6	0.5	0.9	5.0	0.4	0.4	0.4
Barge Equipment	3.1	3.0	8.5	38.9	2.6	2.8	2.7
Pick-up Truck	0.2	0.2	2.3	0.2	0.0	0.0	0.0
Clamshell Sediments							
Tug Boat	32.0	30.7	49.2	285.4	20.0	23.1	22.2
Crew Boat	1.1	1.1	1.7	9.9	0.7	0.8	0.8
Barge Equipment	3.1	2.9	8.3	38.2	2.5	2.7	2.6
Pick-up Truck	0.4	0.4	4.5	0.5	0.0	0.1	0.1
Spoils Pump-out							
Hydraulic Dredge	4.0	3.9	11.0	50.5	3.4	3.6	3.5
Tug Boat	1.8	1.7	2.7	15.7	1.1	1.3	1.2
Generator	0.2	0.2	0.7	3.1	0.2	0.2	0.2
Launch	7.5	7.2	22.4	0.0	0.0	0.0	0.0
Spoils Pump-out							
Land-based Equipment	6.0	5.7	50.5	73.9	7.4	6.1	5.9
Total	101.4	97.3	226.5	891.6	64.3	71.2	68.4
Mitigated Emissions	86.2	82.7	226.5	757.9	3.2	71.2	68.4

Impacts -- Air Quality

Montezuma Wetland. Table 4.1.4.8-1 shows the reduction in project TOG/ROG, SO₂, and NO_x emissions due to the implementation of two degree injection timing and reformulated diesel fuel. These data show that these mitigation measures would reduce project SO₂ emissions to insignificance. However, TOG/ROG and NO_x emissions would remain significant.

To minimize the impact of fugitive dust emissions during site preparation and land-based handling of spoils, the following dust control measures are recommended:

- Apply water at least twice daily to dirt roads, graded areas, and dirt stockpiles to prevent excessive dust emissions.

- Minimize vehicle speeds in dusty areas.

- After completion of disposal activities, treat barren soil areas by watering or revegetating or spreading soil binders to prevent wind erosion of the soil.

- Designate personnel to monitor disposal activities to ensure that fugitive dust would be minimized.

- Suspend land-based handling of dry spoils when wind speeds (as instantaneous gusts) exceed 25 mph.

4.2 HYDROLOGY, GROUNDWATER, AND WATER QUALITY

4.2.1 Conceptual Model of Water Quality Impacts

4.2.1.1 Aquatic Disposal

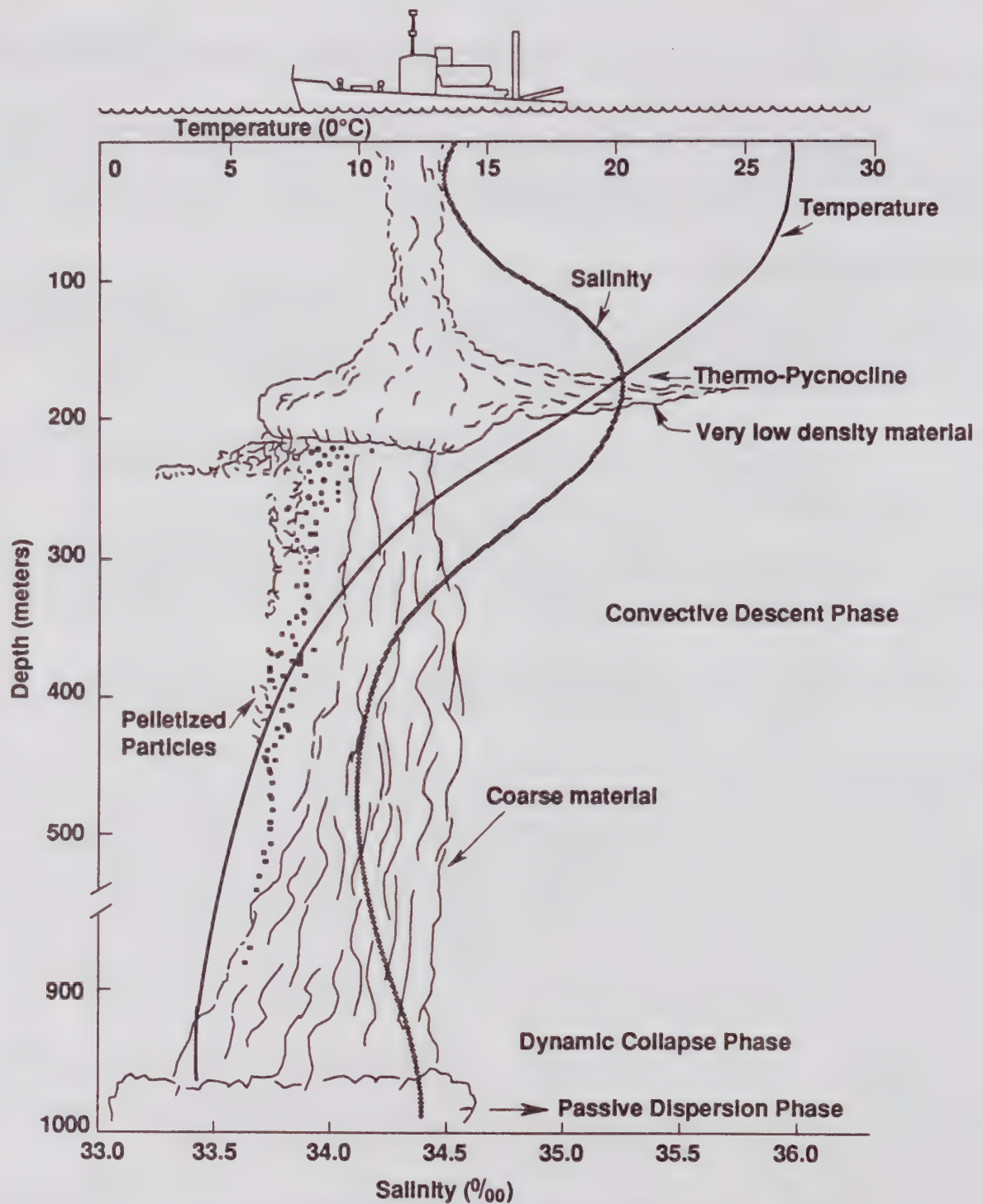
The disposal of dredged material in the marine environment (i.e., at ocean and in-Bay disposal sites) occurs through three major phases which affect the behavior of the material in the water column and the nature of the deposit on the bottom (see Figure 4.2.1.1-1). These are:

1. *The Convective Descent Phase* during which the majority of the dredged material is transported to the bottom under the influence of gravity as a concentrated cloud of material;
2. *The Dynamic Collapse Phase* following impact of the bottom where the vertical momentum present during the Convective Descent Phase is transferred to horizontal spreading of the material; and
3. *The Passive Dispersion Phase* following loss of momentum from the disposal operation, when ambient currents and turbulence determine the transport and spread of material.

During convective descent of the disposal process, water is entrained with the disposal cloud, resulting in a gradual decrease in the concentration and density of the discharged material. This entrainment of water and the residual dispersal of sediment washing out of the disposal vessel will result in some portion of the dredged material remaining in suspension throughout the water column after disposal. Since these suspended sediments are not transported as part of the dredged material plume, the ultimate fate of this material depends primarily on its settling rate and the ambient currents in the area (SAIC 1987). In deep ocean sites, where salinity gradients are well-defined (i.e., the pycnocline), the descent of fine materials will be slowed by the abrupt change in water density and will likely experience dynamic collapse and horizontal spreading well before contact with the bottom (see Figure 4.2.1.1-1) (Pequegnat et al. 1978).

The second phase of transport occurs when the cloud begins a dynamic vertical collapse, characterized by horizontal spreading upon contact with the bottom (Clarke et al. 1971). The material flattens out and is similar to the base surge cloud in a detonation-type event as the dredged material plume assumes a horizontal circular shape with a small vertical dimension (COE 1976, Appendix C).

During the last phase, passive dispersion, particles settle and can be advected and dispersed by bottom currents and turbulence caused by disposal. The concerns of dredged material disposal are that disposed materials will impact the disposal environment, including the water column, bottom sediment, and biological resources (Pequegnat et al. 1978). Potential impacts on the disposal environment are discussed in the following sections.



NOTE: This figure of dredged material disposal is adapted to a two-layered deepwater system (1000m) with a strong thermo-pycnocline.

Source: Pequegnat et al., 1978.

Figure 4.2.1.1-1

TRANSPORT PROCESSES DURING OPEN-WATER DISPOSAL

4.2.1.2 Upland Disposal

The following discussion addresses upland sites (e.g., Galbraith Golf Course), upland sites that were former wetlands (e.g., Leonard Ranch), and upland sites that would become wetlands if developed as dredged material disposal areas (e.g., Sonoma Baylands and Montezuma Wetlands).

Assessment of the impacts of dredged material disposal in upland environments depends on the specific disposal and management options at the disposal site and can be divided into short-term and long-term effects. The following conceptual model of release is applicable to those sites in which hydraulic disposal is proposed, such as for Leonard Ranch, Sonoma Baylands, and Galbraith.

- In the short term, the predominant release mechanism would be the discharge of effluent water decanted from the slurried sediments during the disposal period. This discharge is considered temporary because it occurs during disposal. Initially, during disposal, effluent will be held within holding ponds and then discharged to surface receiving waters. Since the water content of the dredged material slurry would be approximately 70 to 80 percent and consist largely of makeup water, the composition of the effluent and water that is discharged or infiltrates groundwater is expected to be largely that of the original makeup water plus anything released from the sediment during dredging and transport.
- In the long term for the non-tidal options of Galbraith and Leonard Ranch, the potential release mechanisms would include percolation of rainfall through the sediments and surface runoff and sediment erosion into receiving waters. Once the disposal operations are completed, the dewatering process begins. This dewatering process involves discharging surface runoff that includes rainfall runoff as well as water resulting from consolidation and dewatering of the dredged material. This phase may last longer than a year. During dredged material dewatering, pore water from the original sediments and makeup water used in the slurry could potentially infiltrate and impact groundwater and surface waters. Rainfall falling on the dredged material would percolate through the dredged material and could gradually leach out salt and other soluble constituents. The implementation of long-term management options such as soil amendments (reconditioning) and/or covering dried dredged material with topsoil (e.g., re-establishment of a golf course at Galbraith) or removal and off-site disposal (e.g., Leonard Ranch) will likely reduce surface erosion and/or rainwater runoff or infiltration.
- If wetlands are created with the sediments as proposed at Sonoma Baylands or Montezuma Wetlands, other potential long-term release mechanisms would include leaching of constituents from sloughs constructed within the sediments, the physical erosion and transport of the sediment by surface water currents and runoff, and selective uptake and biomagnification in plants and animals. However, the sediments selected for use as cover material for tidal marsh restoration at Sonoma Baylands or the Montezuma Wetlands Project are the least contaminated, to minimize the potential for bioaccumulation. Maintenance of wet, anaerobic sediment conditions will minimize pH changes and increases in leachability of heavy metals and other substances. This will be enhanced by the site design, which will promote sedimentation as a physical sink for incoming tidal sediment.

4.2.2 Testing Methodology

The USEPA/USACE technical framework describes appropriate testing procedures that can be used to evaluate contaminant pathway migration from dredged material placed in aquatic, wetland, and/or upland environments (USEPA/USACE 1992). Interpretation of test results from implementation of these procedures with Oakland sediments are described by Lee et al. (1991).

4.2.2.1 Testing Framework for Aquatic Disposal

Dredged material proposed for disposal at aquatic sites must undergo testing to determine its potential effects on the disposal site environment, and whether it is suitable for unconfined aquatic disposal. For ocean disposal sites, these testing requirements are defined by 40 CFR 227.6. Implementation guidance is provided by the *Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual* (COE/EPA 1991), also known as the "Green Book," promulgated under the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972. For disposal sites in, or potentially affecting, inland waters (such as sites within San Francisco Bay), Section 404 of the Federal Water Pollution Control Act (FWPCA) of 1972 as amended by the Clean Water Act (CWA) of 1977 defines the testing requirements. The tests required by these regulations include biological toxicity and bioaccumulation. Determinations of suitability or unsuitability for unconfined aquatic disposal are made on the basis of these tests. An overview of the testing requirements for material proposed for aquatic disposal is provided at the beginning of the biological impacts section (4.4) of this SEIR/S.

Some of the tests performed on material proposed for aquatic disposal are designed to evaluate the compliance of the proposed disposal action with applicable water quality requirements. For ocean disposal, these tests and related analyses determine whether the dredged material, upon disposal, will meet the limiting permissible concentration (LPC) for water column impacts. The LPC for water column impacts is defined by the "Green Book" as the concentration of any dissolved dredged-material constituent that, after allowing for initial mixing, will not exceed applicable marine water quality criteria (WQC). For constituents lacking WQC, or where synergistic effects between constituents are suspected, the LPC is defined as 0.01 of the acutely toxic concentration of dredged material. The acutely toxic concentration is defined as the concentration of dredged material (LC50) that results in the mortality of 50 percent of the test organisms in suspended particulate phase bioassays. For ocean disposal under the MPRSA, this LPC applies anywhere in the water column after the 4-hour initial mixing period or outside the boundaries of the disposal site at any time following disposal.

For disposal in inland waters under the CWA, the applicable water quality requirements are the state water quality standards (WQS). The State of California has proposed to adopt the federal WQC as state WQS. In addition, under Section 401 of the CWA, the state defines the mixing zone. Although the LPC is defined by the "Green Book" under the MPRSA, the CWA water quality requirements are generally considered to have been met if the LPC is met. The most conservative and commonly applied way in which compliance with the water column LPC is demonstrated is the second approach described above, that is, using disposal modeling methods to demonstrate compliance with the LPC based on the suspended particulate phase LC50.

For the Oakland Harbor deepening project, the Disposal from Instantaneous Dump (DIFID) module of the EPA-approved model Short-Term Fate (STFATE) was used to estimate the concentration of dredged material in the disposal plume and outside the disposal sites at various times following disposal. These

concentrations were compared to the LPC at the appropriate time and locations to determine compliance with the LPC. The LC50 for material potentially disposed aquatically was 31.5 percent, so that the LPC became 0.315 percent.

4.2.2.2 Testing Framework for Upland Disposal/Wetland Creation

The potential impacts on groundwater and surface water quality in upland disposal scenarios may be evaluated by tests designed to simulate or estimate the impacts of dredged sediment disposal on an environmental medium. Table 4.2.2.3-1 presents a brief summary of the tests that have been completed on Inner and Outer Harbor and Turning Basin Port of Oakland sediments for aquatic and upland disposal as well as wetland creation and estimated potential water quality impacts. Table 4.2.2.3-1 includes a summary of biotoxicity/bioaccumulation tests that have been completed on Inner and Outer Harbor sediments. For a more complete description of the details of the testing programs, please refer to the Sediment Quality Report (Port of Oakland 1991a) and the original documents (Word et al. 1988; Word et al. 1990a, 1990b, 1990c; Kohn et al. 1992a, 1992b; Pinza et al. 1993; McFarland et al. 1994; Lee et al. 1991, 1992, 1993; HLA 1989; Patrick 1990a).

Numerous tests have been completed on the 42-foot Project Inner and Outer Harbor and proposed Inner Harbor Turning Basin Wings sediments to evaluate bulk sediment chemistry and expected surface runoff, effluent, and leachate water quality under upland disposal scenarios. Tables K-1 and K-2 in Appendix K describe testing methods; Tables K-3 through K-8 provide summaries of analytical results for the tests. Table K-1 presents a comprehensive summary of the tests that have been completed, including the test name, environmental pathway evaluated, report reference, general sample location, parameters, preparation methods, extraction methods, and analysis methods.

Tables K-3, K-6, and K-9 present data for samples suitable for upland disposal. Tables K-4, K-5, K-7, and K-9 summarize data from Waterways Experiment Station (WES) (1992, 1993) for tests completed on composite samples of material from the Inner and Outer Harbor and Turning Basin Wings that may be suitable for upland and/or ocean disposal. Specifically, samples in WES 1993 were composites of O-C1 to O-C13 areas and I-C1 to I-C18 areas. WES 1992 samples were collected from the Turning Basin Wings (see Figure D-1). In addition, composite samples of Inner and Outer Harbor sediments were tested using wetland bioassays under wetland conditions (Lee et al. 1991). These data are discussed in section 4.4, Biological Resources.

Sediment Quality

Bulk (total) chemistry tests have been completed by Battelle (Word et al. 1988; Word et al. 1990a, 1990b, 1990c; Kohn et al. 1992a, 1992b; Pinza et al. 1993; Lee et al. 1992, 1993) following protocols developed for sediments proposed for ocean disposal, the WES (Lee et al. 1992, 1993); HLA (1989); Woodward-Clyde Consultants ([WCC] 1988). Test details provided in the Battelle reports are summarized in Table K-4. Preparation, extraction, or analysis details were provided in Appendix A of the Lee et al. 1991 report and similar to those described in Lee et al. 1992. Almost all samples from the testing conducted at WES were analyzed at Battelle Northwest Laboratories, following EPA protocols. HLA and WCC followed standard EPA analysis protocols. In general, Battelle's analysis of sediments followed established EPA protocols such as those found in *Test Methods for Evaluating Solid Waste* (SW-846; EPA 1986). Some minor modifications to EPA SW-846 methods were made as noted in the

Table 4.2.2.3-1. Water Quality and Biototoxicity Tests
(page 1 of 2)

<i>Disposal Type</i>	<i>Environmental Impact Predicted</i>	<i>Test</i>	<i>Reference</i>
Aquatic	Water column (short term)	Elutriate	USEPA/CE 1977 USEPA/USACE 1992
		Suspended particulate phase	USEPA/CE 1977 USEPA/USACE 1992
	Benthic	Solid phase toxicity	USEPA/CE 1977 USEPA/USACE 1992
		Bioaccumulation	USEPA/CE 1977 USEPA/USACE 1992
Upland	Effluent release (short term)	Modified elutriate test	Lee et al. 1991, 1992
		Pore (interstitial) water	HLA 1989; Lee et al. 1992
	Surface runoff (short and long term)	Rainfall simulator	Lee et al. 1991, 1992
		Field tests of surface water runoff	Patrick 1990a
		Oxidation and acidification tests	Patrick 1990a
		Field tests of exposed sediments for soluble metals	Patrick 1990a
	Leachate (short and long term)	Simulated rainwater extraction	HLA 1989
		Sequential batch, steady state leach	Lee et al. 1991, 1992
		Kinetic leach	Lee et al. 1991, 1992
		Field tests of exposed sediments for soluble metals	Patrick 1990a
		Pore (interstitial) water	HLA 1989; Lee et al. 1992
		Oxidation and acidification tests	Patrick 1990a

Table 4.2.2.3-1. Water Quality and Biototoxicity Tests
(page 2 of 2)

<i>Disposal Type</i>	<i>Environmental Impact Predicted</i>	<i>Test</i>	<i>Reference</i>
Wetland	Toxicity to aquatic organisms	Elutriate bioassay	HLA 1989
	Toxicity to terrestrial invertebrates	Earthworm bioassay	Lee et al. 1991, 1992
	Bioaccumulation in plants	Plant bioassay	Lee et al. 1991, 1992
	Bioaccumulation in terrestrial invertebrates	Earthworm bioaccumulation	Lee et al. 1991, 1992
	Effluent release (short term)	Modified elutriate	Lee et al. 1991
	Surface runoff (short and long term)	Rainfall simulator (anaerobic, wet)	Lee et al. 1992
	Leachate (short and long term)	Leachate (anaerobic)	Lee et al. 1992
	Toxicity to wetland plants	Plant bioassay (wetland)	Lee et al. 1991
	Bioaccumulation in plants	Plant bioassay (wetland)	Lee et al. 1991
	Toxicity to wetland animals	Animal bioassay (wetland)	Lee et al. 1991
	Bioaccumulation in animals	Animal bioassay (wetland)	Lee et al. 1991

references listed in Table K-1; however, the basic sample preparation, extraction, and analysis methods followed the EPA protocols for analysis of sediment samples.

Surface Runoff and Short-Term Effluent Discharge

EFFLUENT

To assess potential water quality of effluent discharged during hydraulic placement operations at a disposal site, the WES conducted modified elutriate testing on one Inner Harbor composite, one Outer Harbor composite, and two composite samples from the Inner Harbor Turning Basin Wings using the procedure developed by Palermo (1985). Table K-2 provides additional details on these tests from Lee et al. 1992 and 1993. Other than differences in the list of test parameters, no significant difference in methods was noted between Lee et al. 1992 and 1993.

SURFACE RUNOFF

To assess potential water quality of surface runoff after placement of the dredged material in a disposal site, the WES conducted rainfall simulator/lysimeter tests on one composite of Inner Harbor sediment, one composite of Outer Harbor sediment, and two composite samples from the Inner Harbor Turning Basin Wings using the procedure developed by Skogerboe et al. 1987. The tests were conducted initially on wet sediment and then repeated six months later on the air dried sediment to simulate the initial wet anaerobic state of the fresh dredged material and finally on the aged, dried, aerobic state of the dredged material. Run-off water samples were analyzed on a filtered (dissolved) and unfiltered (total) basis. This laboratory test procedure has been found to simulate field conditions extremely well and has given accurate predictions of the potential for contaminant migration in surface runoff from disposal sites (Skogerboe et al. 1987). Table K-2 provides additional details on these tests from Lee et al. 1992 and 1993. Other than differences in the list of test parameters, no significant difference in methods were noted between Lee et al. 1992 and 1993.

Modified elutriate testing was conducted by the WES on two Inner and Outer Harbor composite samples and two Turning Basin Wings composite samples using the test procedure developed by Palermo (1985) to evaluate the water quality of effluent discharged during short-term hydraulic placement at a disposal site. Table K-2 provides additional details on these tests. Other than differences in which the list of parameters were tested for, no significant methods differences were noted between the WES 1992 and 1993 reports.

Leachate

To evaluate the potential leachability of contaminants from sediments, six general types of tests have been conducted. The USEPA and the USACE have developed a technical framework to evaluate disposal of sediments/dredged material in upland disposal environments (USEPA/USACE, 1992). The basis of this framework includes 20 years of research and development and test results for dredged material from each part of this nation, including Oakland Harbor sediments. According to this framework, specific test procedures were developed and field verified for specific pathways of contaminant migration at a disposal site. Leachate test procedures have been and continue to be developed and refined to predict the potential for contaminants to leach from sediments placed in upland and wetland environments. The procedures simulate the environmental conditions that occur at disposal sites and consequently evaluate wet, anaerobic

as well as drier, aerobic conditions of the dredged material. These procedures include kinetic, sequential, and column tests and have been conducted by the WES on one composite sample from Inner Harbor, one composite sample from the Outer Harbor (Lee et al. 1993), and two composite samples from the Inner Harbor Turning Basin Wings (Lee et al. 1992).

Other test procedures have been used to evaluate leachability. A simulated rainwater extraction test was performed on four composite Inner Harbor Turning Basin Wing samples. Pore water (interstitial water) has been analyzed to evaluate potential leachability of contaminants. Three pore water samples from Inner Harbor Turning Basin Wings sediments were analyzed by HLA (1989) and two by the WES (Lee et al. 1992). HLA's samples were obtained by gravity draining fresh sediments over a period of a few days; the WES samples were obtained by centrifugation under an air-free atmosphere. In both tests the sample was filtered before analysis. The gravity draining procedure may introduce oxygen into the pore water solution, which may change the solution chemistry. This may represent pore water that leaches from the sediment onto the surface of the disposal site but will not represent the pore water that leaches down into the anaerobic dredged material below the surface. The centrifugation and filtering of samples under an air-free atmosphere represents the pore water that leaches down into and through the lower anaerobic layers of dredged material at a disposal site.

The waste extraction test (WET) (Title 22, California Code of Regulations [CCR], Article 3) was also conducted on five samples from the Inner and Outer Harbor and on seven samples from the Inner Harbor Turning Basin Wings. Tables K-1 and K-2 present a summary of key elements of each of these tests.

Each of these tests is designed to evaluate leachability; however, leaching potential is approached in several different ways. The primary differences between these tests concern the leaching fluid, contact time, liquid to solid ratio, leachate solution replacement, and the mode of contact, as follows:

- The WET is designed to simulate an acidic landfill leachate environment and establish the leachable concentration from materials tested. WET results are then compared to state soluble threshold limit concentration (STLC) standards to determine if sampled materials are hazardous wastes and therefore unsuitable for disposal in a Class III landfill. Batch WETs were conducted over a 48-hour period using an acidic sodium citrate solution at pH = 5, at a liquid-to-solid ratio of 10:1.
- The kinetic batch test consists of shaking samples in deoxygenated, distilled, deionized water (neutral pH) over a period of up to 10 days at a liquid-to-solid ratio of 4:1 and is intended to simulate leaching from an upland disposal site.
- The sequential batch test is same as the kinetic batch test, except that the leaching solution is replaced every 24 hours.
- The column leach test is intended to mimic disposal site field conditions and consists of flushing deoxygenated, distilled, deionized water through a column packed with sediment.
- The simulated rainwater extraction test used distilled water, amended with CO₂ (to simulate a dilute, slightly acidic, and unbuffered rainwater solution), as the leaching fluid and followed the same procedures (e.g., shaking time, liquid to solid ratio) as the WET.

The significance of these test method differences is as follows. The WET tends to overestimate the leachability of sediments. This is because the low pH leachate solution (pH = 5.0) does not mimic the expected pH of leachate associated with either wet or dry Inner and Outer Harbor or Inner Harbor Turning Basin Wings sediments disposed in upland environments. In upland environments, the pH of dredged sediments may drop as sulfides in the sediments are oxidized and acid is created. However, past experience with Inner and Outer Harbor and Inner Harbor Turning Basin Wings sediment (HLA 1991) has not shown that sediment pH substantially drops as the sediments dry and oxidize; for example, results for the rainfall simulator/lysimeter and sequential batch leaching tests, indicate that pH ranged from 6.88 to 8.29 in wet (anaerobic) sediments and 6.1 to 9.8 for dry (aerobic) sediments (Tables K-2 and K-5). If sediment is placed at an upland disposal site, similar pH values are expected in the sediment leachate or runoff. At this range of pH values, metals typically are not substantially leachable. Furthermore, the use of sodium citrate in the WET leachate as a chelating agent may make the test more aggressive toward certain wastes, or waste components (Environment Canada 1990), such as metals bound to clay particles.

In evaluating potential water quality impacts due to the release of leachate, the WES tests provide a more realistic estimation of the potential for leaching than the acidic WET. The WES used deoxygenated, distilled, deionized water, which more closely resembles rainwater, the precursor to sediment leachate. Tests are conducted for longer durations and at lower liquid to solid ratios than are kinetic and sequential batch tests. These factors tend to provide more time to leach metal species and reduce the amount of dilution of the leachant solution caused by the volume of the leaching solution (e.g., for the WET, 10 parts of leachant to 1 part of sediment versus 4:1 for the WES shake tests). Because the WES tests were conducted over a period of many days, and in the case of the column tests, months, the leachant data obtained from these tests provide more information on the patterns (e.g., rate, duration) of sediment leaching and a more accurate representation of potential leaching from the sediments.

Likewise, the simulated rainwater extraction tests provide a better estimate of leachability than the WET. This is because a CO₂-amended distilled water with pH of about 4.3, similar to rainwater, was the leaching fluid. Overall, because of the longer duration and lower liquid to solid ratio of the COE tests, the kinetic batch, sequential batch, and column tests are expected to be the best estimates of leaching potential for Port sediments.

In addition to these tests performed on samples slated for upland disposal in the 42-foot project, previous tests completed on Phase I sediments provide additional detail on the general geochemical conditions and response of Port estuarine sediments to upland disposal scenarios.

Patrick (1990) conducted laboratory incubation tests over a 90-day period on fresh Inner Harbor sediments and investigated the acidification of sediments and release of metals under oxidative (aerobic) conditions. Tests were also conducted on chemical oxidation and acidification to determine the solubility and leachability of heavy metals from Port of Oakland sediments.

In addition to tests completed on fresh Harbor sediments, Patrick (1990) conducted tests on dredged Inner Harbor Turning Basin sediments deposited on the south levee of Twitchell Island. Samples were collected three times over a period of about four months to evaluate the release of metals from oxidized Inner Harbor sediments under field conditions.

These studies of metals release from wet and oxidized sediments under upland conditions probably represent the worst case estimates or simulations of potential water quality impacts. This is because many

of the tested materials were either sampled directly from the Inner Harbor Turning Basin Wings near Schnitzer Steel and Todd Shipyard or from sediments dredged from this area and deposited on Twitchell Island. These sediments generally have the highest metal concentrations yet measured in the Port of Oakland sediments.

4.2.3 Results of Testing

4.2.3.1 Test Results for Aquatic Disposal

The dispersion of dredged material at the ocean site and the Borrow Area site was simulated by the Corps using the disposal from instantaneous dump (DIFID) (COE 1993b,c). This analysis showed that the limiting permissible concentration (LPC) requirements (0.315 percent) would be met by a considerable margin at both sites. These results, and the implications for water quality and biological impacts, are addressed more fully in sections 4.2.7.1, 4.2.7.3, 4.4.3.1, and 4.4.3.3. Modeling for the Alcatraz site has not yet been completed, as discussed in section 4.2.7.2.

4.2.3.2 Test Results for Upland Disposal

The major conclusions regarding upland water quality impacts from studies by Lee and others (1992 and 1993), Patrick (1990), and HLA (1989, 1990, 1994) include the following:

- On a concentration and total mass basis, sodium chloride (salt) is the primary contaminant released from Port sediments disposed upland in a freshwater environment;
- Metals (e.g., copper, arsenic, cadmium, zinc, nickel, and lead) and organic compounds (e.g., PAHs and tributyltin) may be released from Port sediments in upland environments at concentrations in effluent, leachate, and surface runoff at levels above water quality standards without consideration of dilution prior to or during release;
- With dilution and management options, concentrations in released waters (effluent, leachate and runoff) can be reduced to levels below water quality standards. For example, management options and engineering design applied to hydraulic disposal can reduce the release of particulates, which in turn reduces the concentrations of metals and organics in released effluent (Lee et al. 1992); soluble metals, however, may require additional management to reduce concentrations to below state water quality standards;
- The geochemical requirements necessary to generate wide-spread and significant acidification of the Inner Harbor sediments upon drying and oxidation in upland environments are not present in the sediments (i.e., the sulfide and organic carbon content of the Inner Harbor sediments is low and, due to the relatively large cation exchange capacity of the clayey sediments, the native acid neutralization capacity of the Inner Harbor sediments is high). For example, the surface area occupied by dry low pH regions (pH of between 3.22 to 4.59) on the dredged sediments deposited on Twitchell Island is less than 5 percent of the total area of the deposited sediment (HLA 1990; Patrick 1990) indicating that low pH areas are limited in extent; and

- On the basis of laboratory tests and field measurements of pH from the dredged sediments on Twitchell Island, the average pH of the sediments following drying and oxidation is almost always above 6. Above 6 pH, significant metals mobilization will not occur.
- The results of the Waste Extraction Tests (leachate test performed according to State standard methodology) are discussed in section 4.2.7.6.

4.2.3.3 Test Results for Wetland Creation

A comparison of the sediment analytical data for the material suitable for ocean disposal to the RWQCB interim sediment screening criteria shows that approximately 2.8 mcy of the dredged material could be considered for use at Sonoma Baylands. This determination was made excluding chromium as a criterion. If chromium is used in the determination, only 0.2 mcy are suitable for wetland cover. The Port and Corps have determined that the chromium criterion is not appropriate for evaluating Oakland Harbor sediments because the chromium present is of natural origin (except for localized areas in the vicinity of former dry dock operations). In addition, while the chromium detected is biologically available, the naturally occurring chromium has not been toxic to test organisms in laboratory tests. For a more detailed discussion of the chromium issue, see section 4.2.7.5.

Based on the Lee et al. (1991) evaluation of wetland creation with Oakland sediments, test results for a composite sample of Oakland Outer Harbor sediment indicated plants and animals (snails and mussels) would contain similar amounts of contaminants as those collected from and exposed to existing wetland sediments around San Francisco Bay (Lee et al. 1991).

Lee's evaluation showed that sediments from the Oakland Inner Harbor may be suitable for wetland non-cover only. However, since these tests were conducted, it has been determined that only material that has been found suitable for wetland cover and unconfined ocean disposal will be proposed for wetland cover material. Some of the sediments tested by the WES (Lee et al. 1991) included material that has recently been determined to be unsuitable for unconfined aquatic disposal and unsuitable for wetland cover according to the RWQCB's interim sediment screening criteria. Consequently, the WES (Lee et al. 1991) test results may be conservative and overestimate bioaccumulation in wetland plants and animals. Even so, Oakland Outer Harbor sediments produced plants and animals similar to existing wetlands in all but one, PAH and pyrene in clams, and therefore these sediments were recommended for use in wetland creation/restoration. It is reasonable to assume that by removing the more highly contaminated material from the material disposed at Sonoma Baylands, the levels of bioaccumulation in wetland species would also decrease. In short, wetland restoration with the proposed Oakland material should result in wetland conditions with equal or perhaps less bioaccumulation potential than existing natural wetlands in the San Francisco Bay area. Lee et al. (1991) concluded that sediments from the entire Oakland Outer Harbor appeared to be suitable for wetland cover.

For sediments that would be used as non-cover material (i.e., material to be buried 3 feet or more under cover material in a wetland creation or restoration project), suitability is determined according to the RWQCB's interim sediment screening criteria (RWQCB 1992). Approximately 5.6 mcy of materials for this project are considered suitable for use as non-cover material in a wetland, again without reference to the chromium criterion.

The determination of whether sediment is suitable for wetland creation is subject to confirmation by the RWQCB.

4.2.4 Impact Significance Criteria

Surface water and groundwater quality impacts were considered significant if project activities would result in:

- Alteration of existing regional scale hydraulic conditions (i.e., groundwater flow direction or gradient and surface water flow direction or velocity). Within this context, a significant regional impact is defined as one of similar size, concentration, or duration as currently exists. For example, if the volume of water released as effluent from hydraulic upland disposal were of the same magnitude as existing regional freshwater surface water flows, this impact would be considered significant.
- Exceedance of the state water quality standards or objectives (e.g., RWQCB Basin Plan Objectives and state maximum contaminant levels [MCL]), where applicable, based on specific site conditions, discussed in section 3.2.
- Long-term sedimentation and/or erosion above existing rates that would affect the operation of water control structures, gates, or valves.
- Increased flooding that could cause impacts on the integrity of the site design or surrounding areas.
- Exceedance of RWQCB interim sediment screening criteria for sediments to be used for wetland restoration/creation with the exception of chromium (RWQCB 1992). Total chromium concentrations does not appear to be an accurate indicator of toxicity or bioaccumulation for Oakland project material (and possibly for San Francisco Bay), as discussed in section 4.2.7.

Temporary impacts coincide with project dredging. A short-term impact occurs during physical placement of the material at a drying site and does not include longer-term post-disposal issues such as drying, handling, and recontouring of dredged sediment material.

In addition to consideration of the above criteria, an implicit criterion for the aquatic disposal sites is that, in order for impacts on be considered not significant, the dredged material would, at a minimum, have to be disposed of in accordance with the testing requirements of the MPRSA (ocean disposal site) and CWA (in-Bay disposal sites), since these requirements are considered protective of water quality. These testing requirements would include the tests for LPC compliance as discussed above in section 4.2.2. Since only material deemed suitable for unconfined aquatic disposal according to the testing requirements of the MPRSA and CWA would be disposed of at the Ocean and Alcatraz sites, disposal at these sites is considered automatically to have no significant water quality impacts according to this criterion. In addition, disposal at the ocean site has been shown to meet the LPC requirement (sections 4.2.3 and 4.2.7.1).

At the Bay Farm Borrow Area, however, material deemed unsuitable for unconfined aquatic disposal according to the testing requirements of the CWA would be disposed of in an unconfined aquatic condition prior to being capped with suitable material. Therefore, disposal at this site does not strictly meet the "disposal according to testing requirements" criterion. In this case, LPC compliance is the appropriate water quality significance criterion, since this standard is designed to provide adequate protection of water quality. As described in section 4.2.3 above, disposal at the Bay Farm site is expected to meet the LPC requirement, so that water quality impacts would not be considered significant by this criterion.

4.2.5 Regional

The water bodies potentially affected by dredging and disposal operations associated with this project include Central and South Bays of San Francisco Bay and the area surrounding the deep water ocean site west of the Farallon Islands. Impacts on water quality are highly dependent on local and regional hydrodynamics that determine the mixing and dispersal of suspended dredged material (i.e., sediment loading). Elevated levels of suspended sediments can deplete dissolved oxygen, elevate nutrients levels, and release contaminants in the water column.

Regional impacts on water quality are expected to be insignificant during this project due simply to existing water quality conditions in the receiving waters. For the ocean site, the maximum volume of dredged material that could be deposited there will be minuscule in comparison to the existing volume of site waters. Suspended sediments concentrations are predicted to be relatively low, and elevated levels will be ephemeral. All materials disposed at the site will be in compliance with MPRSA regulated water quality criteria (i.e., LPC). Potential impacts on ocean site waters are discussed in section 4.2.7.1.

Disposal operations at the in-Bay sites, the Bay Farm Borrow Area (BFBA) and the Alcatraz disposal site, and dredging operations in Oakland Harbor will contribute to the suspended sediment load in the Bay. Elevated suspended sediments concentrations during dredging and disposal, however, will be short-lived, and significant impacts on the water column will potentially be avoided. Only materials in compliance with the LPC will be disposed of at the in-Bay disposal sites (see sections 4.2.7.2 and 4.2.7.3).

Although not an input *per se*, resuspended sediment from the Bay seafloor constitutes the majority of sediment carried and transported in Bay waters (approximately 160 mcy on an annual basis). In addition, approximately 8.0 to 10.5 mcy of sediment enters the Bay annually from the Delta region (PTI 1989). For this project, the largest volume of material that will be dredged from Oakland Harbor is 6.6 mcy. The largest volume of material that could be disposed of in-Bay is 6.6 mcy (using the BFBA alternative). Based on the available literature describing the fate of dredged material during disposal, a conservative estimate of the percentage of material lost to the upper water column during disposal is 5 percent (Montgomery and Engler 1986; Truitt 1988). Material lost during dredging also is on the order of 5 percent; however, with operational controls in place, material loss will be less, approaching 3 percent. The total volume of sediment put into suspension by dredging and disposal is estimated to be 0.45 mcy.

If the Alcatraz disposal site is used for this project, potentially more sediment will be contributed to the overall in-Bay sediment load budget. Teeter (1987) predicted up to 63 percent of the material disposed at the Alcatraz site that is fluid (or preslurried) could be dispersed from the site to the east and west. Since no more than 4.8 mcy of material may be disposed of at the Alcatraz site, about 3.0 mcy of sediment could potentially be dispersed from the site. In using either disposal alternative, sediment load

volumes caused by in-Bay dredging and disposal are minor contributors to overall regional suspended sediment load.

4.2.6 Oakland Harbor

4.2.6.1 Project Impacts

Hydrodynamics. Waters in Oakland Inner and Outer Harbor areas experience relatively rapid exchange with Central Bay tidal cycles. Current velocities are not available for these areas, although inferences can be made concerning probable sediment transport. Sediments resuspended by dredging activities will move east and west with the tidal cycles in the Inner Harbor. The Outer Harbor benefits from increased exposure to the west and prevailing Central Bay hydrodynamic conditions. Resuspended sediments may be circulated in a counterclockwise eddy located south of the Seventh Street Terminal; but eventually, they will be flushed into South and Central Bays. Adjacent pier structures will, to a certain degree, trap suspended sediments and limit the amount of sediment in circulation.

The removal of sediment from these channels will obviously leave depressions that do not change the local hydrodynamics substantially. Currents associated with tidal cycles will not change. Waters moving over the channels will deposit their suspended sediment load into the depressions; however, current velocities will not change markedly. No significant impact to channel hydrodynamics is expected during or after dredging.

Water Quality. Water quality variables that could be affected by dredging operations are the same as those described for the disposal sites (see sections 4.2.7.1, 4.2.7.2, and 4.2.7.3): total suspended solids, dissolved oxygen, nutrients, pH, salinity, temperature, and concentrations of metals and organic contaminants. Potential impacts on these parameters can be evaluated by reviewing actual field measurements collected during several water quality monitoring studies at dredge sites. One monitoring program performed by the Corps, San Francisco District, during the Mare Island Channel maintenance dredging project in the early 1970s is directly applicable to the dredging work proposed under this project. Effects on the water column by operation of hopper, hydraulic cutterhead, and clamshell dredges were monitored. For the Oakland Harbor project, the hydraulic cutterhead and clamshell dredge are expected to be used.

The Corps study revealed that dredging operations did not typically cause significant fluctuations in salinity, temperature, or pH over the short or long term. Slight fluctuations were detected only one-fourth of the time while the dredges were monitored. During one event, a fluctuation of 0.5 units in pH was observed when potentially acidic materials were released from the dredge. This occurrence was considered aberrant, and background levels were regained within minutes (COE 1976, Appendix C). Surface water quality objectives for these parameters (RWQCB 1986) will undoubtedly be satisfied based on these San Francisco Bay studies.

Nutrient enrichment caused by potential elevated concentrations of phosphorus, nitrogen, and silica in the dredged material may increase water turbidity by enhancing primary production. LaSalle (1984), in a literature review, reported elevated quantities of phosphate, ammonia (as nitrogen), and silica have been measured within 180 m of a working dredge, exceeding background levels by two to nine times. However, when compared with ambient levels as a whole, the dredging operations would cause increased concentrations of nutrients by a maximum of 2 percent for ammonia, 1 percent for phosphate, and 0.5

percent for silica. Impacts would be near-field and transient, with nutrients flushed to the open Bay. No significant impacts are expected.

The two water quality parameters experiencing the greatest fluctuations during the Corps studies were dissolved oxygen and total suspended solids. Dissolved oxygen concentrations tend to decline in the vicinity of dredging operations when the suspension of anoxic sediment creates high biological and chemical oxygen demand. During the Corps study, dissolved oxygen concentrations declined in only four of the 12 measurements. Depressions in dissolved oxygen were greatest in the lower 2 meters of the water column. The greatest fluctuation in dissolved oxygen (3.5 parts per million) occurred at a near-bottom sampling location within 50 m of the dredge. Concentrations declined from 9.0 ppm to 5.5 ppm, which meets the minimum dissolved oxygen requirement of 5.0 mg/l set by the RWQCB (1986). In all cases, background levels in dissolved oxygen were regained within 10 minutes of the sampling event (COE 1976, Appendix C). Dissolved oxygen concentrations during the dredging of Oakland Harbor sediments will decline for very short periods of time. Because ambient dissolved oxygen concentrations are not available for the dredging sites, a prediction as to whether or not dissolved oxygen levels will dip below the 5 mg/l requirement is not possible. Central Bay levels average 7.6 mg/l; as such, dissolved oxygen concentrations in the immediate vicinity of the dredging operations may become depressed below the minimum RWQCB requirement for a short period of time (less than 10 minutes). Due to the short duration of the effect, impacts on dissolved oxygen in the water column are expected to be insignificant.

Concentrations of total suspended solids vary with the material being dredged and the type of dredge employed. Clamshell bucket dredging invariably creates suspended sediment plumes. One plume is associated with the disruption of the bottom on impact and the retrieval of the bucket through the water column. Suspended sediment concentrations can reach several hundred milligrams per liter and can influence areas downstream as far as 500 m away. Another plume is caused by materials spilling from the top of the bucket as it breaks the water surface. Concentrations of 100 mg/l or more have been recorded up to 300 m downstream in this type of surface plume. Gordon (1973) estimated material losses during clamshell dredging to be about 2.5 percent (COE 1976, Appendix C).

During the channel deepening project in San Francisco Bay described by the Corps (COE 1976, Appendix C), suspended sediments concentrations in the water column 50 m downstream from the clamshell dredge were generally less than 200 mg/l and averaged 30 to 90 mg/l. Background levels outside the plume averaged 40 mg/l. Suspended sediments concentrations decreased with increasing distance from the dredging operation. The near-bottom sediment plume extended downstream approximately 450 m (COE 1976, Appendix C).

The amount of sediments suspended by hydraulic cutterhead are vastly reduced compared to the clamshell dredge; however, not all sediments being suspended by the cutterhead will be drawn into the suction tube. In comparison to the clamshell dredge, this percentage of suspended material is very small. Pipelines that extend from the seafloor to the barges all but eliminate mid-water and surface plumes (COE 1976, Appendix C). Suspended materials are restricted to the immediate vicinity of the cutter itself. Elevated suspended sediment concentrations are on the order of a few tens of grams per liter within 3 m of a cutterhead dredge; and a few hundred milligrams per liter within 200 m of the cutter (Barnard 1978). Additional sediment loading can occur when barges containing sediment suitable for unconfined, open-water disposal are allowed to overflow to obtain the most economical load or due to inadvertent spillage.

Suspended solids impacts on the water column might occur at the dredging site. However, levels are not expected to increase above 500 mg/l in the immediate vicinity of dredging activities. Peddicord et al. (1975) and Morgan et al. (1973) measured biological effects of suspended sediments for in-Bay bivalve mollusks and fishes. Delayed development of white perch and striped bass eggs was noted for concentrations of suspended sediment greater than 1,500 mg/l. Hatching of demersal white perch eggs was delayed by one day at suspended sediments concentrations of 4,000 mg/l. Egg mortality occurred for striped bass at 3,400 mg/l and at 3,600 mg/l for white perch (Morgan et al. 1973; cited in O'Connor 1991). *Tapes japonica*, *Mytilus edulis*, and *M. californianus*, bivalves, showed variable responses to 100,000 mg/l kaolin clay for 10 days. The three species demonstrated little significant mortality, 10 percent mortality, and 50 percent mortality, respectively (Peddicord et al. 1975; cited in O'Connor 1991). These studies demonstrate direct biological effects of suspended sediment are caused by extremely high concentrations extending for long periods of time. Based on these available data, significant impacts due to elevated suspended sediment concentrations are not expected.

Proposed Oakland Harbor dredged sediments include a wide range of metals and contaminants concentrations (see Appendix A). Some sediments have been determined to be unsuitable for unconfined, open-water disposal, requiring careful removal and placement at controlled upland sites. Chemical reactions between the suspended sediments and the water column are possible during the dredging operation. These reactions are highly dependent on the redox potential of the seawater, pH, and to a certain degree, salinity (Pequegnat et al. 1978). Oxidation of organic material will promote adsorption and desorption of contaminants; seawater, having a higher pH than the suspended sediments, promotes the desorption of metals, while salinity causes adsorption of chemicals to particulates. All of these factors will occur at the dredging sites, but actual chemical concentrations released to the water column can not be accurately predicted. Realistic measurements could only be obtained in a dredging water quality monitoring program.

The majority of heavy metals, nutrients, and petroleum and chlorinated hydrocarbons are typically associated with the fine-grained and organic components of the sediment (Burks and Engler 1978). However, available data suggest biologically significant release of these constituents during dredging has not been a routinely observed (Francingues et al. 1985). Water quality monitoring data collected during dredging of a metals-enriched site at the Kings Bay, Georgia Naval Base demonstrated elevated metals concentrations were present in the water column, but that metals contamination was not a long-term problem (Alvarez, Lehman & Associates 1985). Laboratory studies describing the behavior of metals and chlorinated hydrocarbons revealed that 70 percent of the copper released by disturbances of bottom sediments was adsorbed onto clay and organic particles, effectively removing it from the water column. In the same way, 97 percent of the mercury and 50 percent of the mercuric nitrate/mercury chloride were adsorbed onto fine-grained and organic components of the sediments (Stern and Stickle 1978). Chlorinated hydrocarbons were noted to be strongly bound to the solid phase, but that with increasing suspended solids concentrations, greater soluble forms of hydrocarbons were detected. It was also noted that the co-occurrence of both oil and grease and chlorinated hydrocarbons may enhance bioavailability (Lee et al. 1975). Any contaminated sediments removed during this project will be placed in barges to a level that will not cause overflow or spillage during dredging or in transit to the disposal site. This measure will reduce suspended solids levels, restricting the potential for contaminants release from the dredged material.

Field measurements of direct metals releases to the water column have been made in the immediate vicinity during past dredging operations. Three examples are relevant to this project because the dredging

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sites are metals-enriched. The three dredging projects took place in San Francisco Bay (Wakeman 1977), Black Rock Harbor, Connecticut, and the Duwamish River, Washington (Havis 1988). The projects reported by Havis (1988) were performed using a clamshell bucket. Direct measurements were summarized in LaSalle (1984) and are presented in Table 4.2.6.1-1.

Table 4.2.6.1-1. Comparison of Historical Contaminants Release Data during Dredging and Basin Plan Water Quality Objectives (all values in $\mu\text{g/L}$; from RWQCB 1986)

	BASIN PLAN WATER QUALITY OBJECTIVES		EXAMPLE DREDGING PROJECT		
	<i>1-hr Average</i>	<i>Instantaneous Maximum</i>	<i>San Francisco Bay</i>	<i>Black Rock Harbor</i>	<i>Duwamish Waterway</i>
<i>Metal</i>					
Arsenic	69	-	-	10	-
Cadmium	43	-	-	1	-
Chromium	1,100	-	30 surface/ 50 bottom	1	-
Copper	2.9*	-	-	10	2
Lead	140	-	10	3	7
Mercury	2.1	-	-	0.01	-
Nickel	-	140	10 surface/ 80 bottom	10	-
Selenium	-	-	-	-	-
Silver	-	2.3	-	-	-
Zinc	-	170	160	30	20

Notes: - = Not Available
* Copper toxicity depends on complexing capacity. Bay background varies from 1 to 4 $\mu\text{g/L}$.

Metals concentrations from the three studies shown do not exceed Basin Plan Water Quality Objectives (with the exception of copper in heavily contaminated Black Rock Harbor). Measurements were compared to screening criteria intended to adequately protect water quality (and hence aquatic organisms) immediately following release of the effluent/dredged material. Because the suspended sediment load is relatively small (i.e., 500 mg/l or less) in the vicinity of the dredging operation, and dilution at most dredging sites occurs quickly, substantial releases of contaminants are not expected (LaSalle 1984). Most metals and organic compounds, as described in section 3.3.2, are not available in a soluble form because they are complexed with iron, manganese, organic matter, and clay particles (Windom 1972; cited in LaSalle 1984).

Water quality impacts on dredging site waters for most parameters are expected to be transient and of little significance. The release of potential toxic chemical constituents to Oakland Harbor waters during dredging might occur for those materials identified in section 3.3.2 as having a coarse-grained texture and low organic content. However, water column impacts due to the release of toxic substances are not expected to be significant based on other historical data shown in Table 4.2.6.1-1.

Potential Groundwater Effects

The San Francisco Bay RWQCB, California Department of Water Resources (CDWR), and the Alameda County Flood Control and Water Conservation District (ACFCWCD) previously expressed concerns that the deepening of the Oakland Harbor channels might promote salt water intrusion into the deeper aquifers

of the Alameda formation through unknown windows in the San Antonio Aquitard, or through abandoned wells that were drilled through the Aquitard into the Alameda Aquifer(s). Considering the full extent that historic dredging has exposed the Merritt Sand to salt water intrusion and the large areal extent of the Merritt Sand, as compared to any sand lens known in the Posey Formation, it would be reasonable to assume that if a window did exist through the San Antonio Aquitard (it has not been proven that one does exist) the waters in the Merritt Sand would already have access to it. Therefore, the only barrier against salt water intrusion is the fresh water hydraulic head within the Merritt/Posey Aquifer. Control of this barrier would be accomplished by regulation of the pumping demand placed on the Merritt/Posey Aquifer. The ACFCWCD biennially samples two water wells that draw from the Alameda formation near the Oakland Inner Harbor. According to their test results there appears to be no salt water intrusion at this time, and the ACFCWCD does not, to the Corps' knowledge, indicate on their Well Inventory Reports any wells drilled into the Alameda Aquifer(s) that have been abandoned due to salt water intrusion. Thus, no significant impacts on groundwater are expected to result from future dredging activities (COE 1992).

Relationship of Merritt Sands to Water Quality Impacts

The EPA has recognized, since technical review panel meetings on March 10 and 11, 1988, that material in Oakland's Inner Harbor that is unsuitable for unconfined ocean disposal is underlain by layers of undisturbed muds and clays that *are* suitable for ocean disposal. That conclusion was based on the initial testing of Oakland material and on confirmatory testing by Battelle that demonstrated that contaminants from the overlying material had not migrated into the undisturbed materials. Tudor Davies (EPA 1988) summarized the results of those meetings by concluding that:

1. All of the material represented by station SN-3 and all of the material represented by the TD stations from the surface of the sediment down to the line of undisturbed clay is considered unsuitable for unrestricted ocean disposal (Figure 2.4-4).
2. The remaining material from the Inner Harbor may be considered as suitable for unrestricted ocean disposal.

Additional work and testing have been completed since that time to analyze the nature and location of the material in the wings of the Inner Harbor Turning Basin (see Figure 2.4-4 for the different areas that have been sampled). That work demonstrates that the recent and softer muds (commonly referred to as Younger Bay Muds) in the Inner Harbor Turning Basin and also in the channel through the Inner Harbor Turning Basin immediately west (Stations IC-10, IC-11, IC-12, IC-29, and IC-30) are unsuitable for unconfined aquatic disposal. Survey work, completed using acoustic sampling, shows that these recently deposited Younger Bay Muds are underlain by geologic deposits of three different types: Older Bay Muds, Merritt Sands, and Younger Bay Muds deposited in a stream channel that had been incised into Merritt Sands.

The crucial issue raised by the analytical information is whether the Younger Bay Muds that are unsuitable for ocean disposal can be separated by dredging from the underlying materials, both sands and muds, that would be suitable for ocean disposal. A substantial volume of clean material underlies the unsuitable material; the geotechnical surveys indicated that approximately 54 percent of the material in this area has never been disturbed and thus would be suitable for ocean disposal. For analytical purposes, the area has been divided into the following four sub-areas:

- The wings of the Inner Harbor Turning Basin (shown in Figure 2.4-4);
- The channel through the turning basin, represented by Stations IC-10 through IC-12 (see Figure 2.4-1);
- The channel bank deposit downstream or west of the turning basin; represented by samples IC-29 and IC-30; and
- The berths.

The initial estimate that 1,368,000 cy (roughly 1.4 mcy) of sediment is unsuitable for ocean disposal represent a "worst case" scenario in which the underlying clean material cannot be separated from the overlying unsuitable material. The wings of the Inner Harbor Turning Basin contribute about 270,000 cy of this unsuitable volume. The channel through the turning basin contributes about 330,000 cy, and the channel bank deposit represents about 110,000 cy. The berths contribute about 155,000 cy. Roughly half of this material, or over 420,000 cy, is actually geologically deposited material that would be suitable for ocean disposal if the material could be dredged separately from the overlying unsuitable sediments.

The Younger Bay Muds that are unsuitable for ocean disposal are not distributed evenly, either vertically or horizontally, within this area of the Inner Harbor. The wings of the turning basin have been considered separately because that area, particularly adjacent to the former Todd shipyard on the southern side of the turning basin, is where the highest levels of contaminants are found. In contrast, the toxicity results for Stations IC-10, IC-11, IC-12, IC-29, and IC-30 in the central channel show little or no toxicity or potential for bioaccumulation. In this center channel area, grain size analysis, the acoustical survey data, and experience from deepening the Inner Harbor to -38 feet MLLW all indicate that undisturbed, well cemented Merritt Sand will initially be encountered at between -38 and -40 feet MLLW. At the wings of the turning basin, it appears that past land reclamation efforts have borrowed material for landfill, and Merritt Sand will not be encountered there until -40 feet MLLW or deeper.

The irregular contour of the undisturbed muds and sands, and the very nature of dredging, limit the accuracy with which material can be removed from the Inner Harbor. Ideally, dredging would separate the soft muds unsuitable for ocean disposal from the suitable harder muds and sands underlying those muds. Recent experience in deepening the Inner Harbor to -38 feet MLLW and in constructing a new terminal at Berth 30 shows that a conventional clamshell dredge bucket will cut through the softer muds but will refuse to cut the more cemented sands. Experience in the Navy's deepening of the Oakland Naval Supply Center shows the Old Bay Muds to be as difficult to dredge as the Merritt Sands. For deepening of both types of sediments, it is necessary to use specialized equipment (either cutterhead dredges or clamshell buckets with rock teeth) in order to deepen the channel into the underlying material.

If dredging using a mud bucket were specified in construction, it would remove the unsuitable material without cutting into the underlying and resistant sediments. However, unless further measures are taken, the dredging operation would leave some residue of softer muds on top of the harder underlying material. The softer mud left behind, even if mixed with a substantial volume of clean, geologically deposited material, may be unsuitable for ocean disposal. These potential impacts would be avoided by the implementation of the mitigation measures in section 4.2.6.2.

4.2.6.2 Mitigation Measures

The present dredging plan stipulated by the Corps includes the mechanical dredging of material unsuitable for unconfined, open-water disposal and either hydraulic or mechanical dredging of material suitable for unconfined aquatic disposal.

Turning Basin. Within the wings of the Inner Harbor Turning Basin shown in Figure 2.4-4, contract specifications will provide for removal of the softer muds with a mud bucket. If required by the RWQCB, additional material would be removed to ensure the removal of softer material unsuitable for aquatic disposal in an area that might be subject to scour in the event of ship movement. At least 1 foot of the hard, bedded material will also be removed. All of this material shall be treated as unsuitable for unconfined aquatic disposal and shall be taken upland.

Channel Area. Within the area of the channel characterized by sample stations IC-10, IC-11, IC-12, IC-29, and IC-30, contract specifications will provide for removal of the softer muds with a mud bucket. Once the bulk of the softer material has been removed, one of the four following measures will be employed to ensure that any remaining material does not have a significant potential for impact at the proposed ocean disposal site:

- a. Removal will continue to project depth, -42 feet MLLW, plus allowable overdepth; or
- b. A minimum removal from the exposed bed, up to 1 foot of material, will occur to ensure removal of the remaining material unsuitable for ocean disposal; or
- c. Removal will be ensured by repeated dredging with a hydraulic dredge or continued removals with a clamshell dredge, where removal is confirmed by survey; or
- d. Construction surveys will be undertaken, using acoustic profiling techniques, that demonstrate that the remaining material in the channel represents so small a volume (i.e., less than 2 percent of the total volume) so that disposal of this material does not result in significant environmental impacts on the marine environment outside of the designated disposal site.

All material removed under a, b, c, or d would be treated as unsuitable for unconfined ocean disposal and disposed at an upland disposal site.

The operation modifications described above would reduce the dredge's production rate; their implementation must be carefully weighed against economic considerations.

Undercutting while using the cutterhead should be avoided. Materials located above the undercut cave in on the cutterhead, increasing turbidity.

Other operational practices to reduce suspended solids levels include avoiding:

- a. Overflow from barges during dredging or transportation of material unsuitable for unconfined aquatic disposal (WDOE 1990);

- b. Site leveling by dragging the bucket over the bottom;
- c. For material unsuitable for unconfined aquatic disposal, excessive overflow from the barges during dredging or transportation beyond that allowed by the RWQCB (WDOE 1990); or
- d. Overflow from barges during transportation to the disposal site.

4.2.7 Disposal Site Options

4.2.7.1 Ocean Section 102

Local and regional hydrodynamics will influence the dispersion and long-term fate of dredged material discharged at the Ocean Section 102 site. The dispersion of sediment particles will, in turn, affect local and regional water quality conditions. The discussions concerning hydrodynamics and water quality that follow are based on disposal plume modeling performed by the EPA (1993a) and the U.S. Navy (1993b) in association with ocean site designation studies, and the Corps (1993c) to determine the suitability of Oakland Harbor sediments for disposal in ocean waters.

Impacts on Ocean Waters

HYDRODYNAMICS. Circulation patterns in the vicinity of the Ocean Section 102 site are generally consistent with California coast hydrodynamics, with some unique characteristics. The area of the preferred ocean disposal site displays poleward, near-surface movement of water over the slope and experiences substantial tidal effects and a non-local source for the upwelled waters occurring on the shelf. These characteristics will affect resuspension and dispersal of dredged material deposited at the Ocean Section 102 site (EPA 1993a).

Current meter data collected in the vicinity of Ocean Section 102 in 1991 and 1992 suggested bottom erosion of a dredged material deposit is likely, given maximum recorded current speeds of between 37 and 43 cm/sec. Materials resuspended as a result of bottom currents of this magnitude would move eastward into a small, submarine canyon. The scant materials transported to this canyon on the eastern side of Ocean Section 102 would probably not be moved upslope and onto the shelf because, in the Gulf of the Farallones, local upwelling is not a dominant means of sediment transport. Cold, saline waters move into the area from a strong upwelling center north of Point Reyes, well away from Ocean Section 102 (EPA 1993a).

Dredged material disposal at Ocean Section 102 will not have a measurable effect on the hydrodynamics in the area. Potential impacts on water quality as a result of local and regional circulation patterns in the vicinity of the ocean site are discussed below.

WATER QUALITY. Water quality parameters potentially impacted by dredged material disposal in Ocean Section 102 include suspended solids (which affect light transmittance), dissolved oxygen, nutrients, salinity, temperature, pH, and concentrations of dissolved contaminants. Alterations in ambient dissolved oxygen levels, nutrient concentrations, salinity, temperature, and pH as a result of dredged material disposal can be predicted using existing field and laboratory data, most of which were collected in association with the Dredged Material Research Program of the Corps (Burks and Engler 1978; Brannon

et al. 1976; Hirsch et al. 1978; Pequegnat et al. 1978; Pequegnat 1983; Lunz et al. 1984). These data were gleaned from studies performed from dredging sites and relatively shallow dredged material disposal sites; impacts on the water column resulting from dredged material disposal in the deep ocean have not been intensively studied.

Changes in pH, salinity, and temperature of ambient waters would be restricted to the descent phase of disposal. In 1972, the Corps, San Francisco District monitored water quality variables during dredging and disposal activities. Although these studies took place at relatively shallow in-Bay disposal sites, their findings can be extrapolated to deep water sites. In general, pH, salinity, and temperature were not substantially influenced either horizontally or vertically during disposal operations. Measurements of pH rarely decreased by 0.10 units; salinity decreased by no more than 2 parts per thousand; and temperature varied less than 1°F. Greatest effects were typically measured within five minutes after release and overall effects dissipated within 10 minutes (COE 1976, Appendix C). Based on these data, entrainment of site waters in the disposal plume would cause minimal localized and short-term impacts of these parameters at the Ocean Section 102 site.

Accurate predictions of changes in dissolved oxygen concentrations during disposal operations using information on the characteristics of the waters and sediments at the dredging and disposal sites are not yet possible (Lunz et al. 1984). In the Corps, San Francisco District studies on water column effects following dredged material disposal, dissolved oxygen declined by up to 2 mg/l in surface waters, lasting up to two minutes. Near bottom dissolved oxygen levels, however, were reported to decline by up to 6 mg/l, although ambient concentrations were regained after an average of three to four minutes. Oxygen increases were also noted following disposal, depending upon the chemical composition of the dredged material, by particulate surface area, and by aeration caused by dredging and disposal operations. The duration of a dissolved oxygen reduction is dependent on the contact time between sediment and water and by the intensity of initial oxygen demand (COE 1976, Appendix C).

Dissolved oxygen concentrations in the water column at the ocean disposal site may potentially decrease during disposal if chemical oxygen demand is increased by the presence of inorganic compounds associated with the dredged material. Although oxidation of labile organic compounds will take place in the upper 400 meters of the water column where waters are well oxygenated, more pronounced effects may be noted in the oxygen minimum zone (at about 800 m) where ambient oxygen levels are less than 1.0 mg/l (EPA 1993a). The potential reduction in dissolved oxygen due to chemical oxygen demand is expected to be restricted to the location of the dredged material plume. Oxygen uptake is unlikely to alter the oxygen content of deep ocean waters encountered at Ocean Section 102, considering the small ratio between the disposal volume and the receiving water column (up to 3,000 m) (COE 1976, Appendix C). Therefore, reduction in dissolved oxygen concentrations in the water column is expected to be an ephemeral effect and insignificant in its impact.

The addition of nutrients (especially nitrogen and phosphorus) to the area during disposal operations may cause enhanced production of phytoplankton. Increased turbidity resulting from disposal, however, would reduce light transmittance and, as a result, tend to depress primary production. This net effect is expected to be small, transient and localized within the discharge plume. No significant impacts are anticipated.

Dispersion modeling performed by the U.S. Navy (1993b) predicted the concentration of dredged material (i.e., suspended solids) occurring at various water depths in the ocean site during the four-hour initial

1 mixing period. This same model, the Implementation Manual's DIFID module of STFATE, was used
2 by the Corps, San Francisco District to predict water column impacts (i.e., toxicity) caused by the release
3 of suspended and dissolved contaminants from the dredged material. This model determines whether
4 disposal of Oakland Harbor dredged material for which the lowest median lethal concentration (LC50)
5 has been calculated is in compliance with ocean disposal guidelines. Potential water column impacts are
6 predicted by comparing concentrations of dredged material in the water column outside the boundary of
7 the disposal site during the four-hour initial mixing period, and the maximum concentration anywhere
8 in the marine environment after the four-hour initial mixing period to 1 percent of the LC50
9 concentration. If the predicted dredged material concentration remaining in the water column after initial
10 mixing is less than 1 percent of the LC50, the LPC for water column impacts is met (COE and EPA
11 1991).

12
13 In the U.S. Navy study, the DIFID model predicted concentrations of dredged material in the water
14 column after the end of the dynamic collapse phase. These calculations were made for materials to be
15 dredged from Alameda and Oakland Naval bases which are similar in character to proposed dredged
16 sediments in this project. Calculations were made for three different types of material (10 percent
17 clumped, 50 percent clumped, and mostly sand) for hydrodynamic conditions expected to occur during
18 each season. The model incorporates numerous data describing disposal operations, the disposal site, and
19 the character of proposed dredged materials. Maximum concentrations of dredged material in the water
20 column during initial mixing under four different seasonal conditions are summarized in Figure 4.2.7.1-1.
21 Maximum concentrations four hours after discharge are expected to range from 63 to 138 mg/l in a zone
22 ranging from 350 to 550 m below the waters surface. These estimates are conservative because the
23 concentrations do not incorporate estimates for fine-grained materials retained in the upper water column
24 during descent (U.S. Navy 1993b). These concentrations of suspended sediments (the majority below
25 100 mg/l) will dissipate quickly in the open ocean.

26
27 For purposes of comparison, effects of suspended sediments on fishes and shellfishes summarized in a
28 literature review performed by Lunz et al. (1984) were compared to predicted dredged material
29 concentrations at the Ocean Section 102 site. Suspended solids ranged in concentration from 50 to
30 300,000 mg/l, with varying degrees of biological effects among different fish species. With the exception
31 of the alewife, biological effects were not noted for concentrations below 500 mg/l. For a species
32 representative of Ocean Section 102, the herring, no significant effects on the hatching success were noted
33 at concentrations as high as 5,000 mg/l. Based on these data, impacts on the water column caused by
34 suspended sediment alone will likely be insignificant.

35
36 Although impacts on the water column are expected to be insignificant, substantial changes to the dredged
37 material during disposal are anticipated. Dredged material will be affected by several physical, chemical
38 and biological processes. These factors include: initial mixing; presence of organic material, clays, iron
39 and manganese oxides and hydroxides; salinity; Eh (redox potential or oxidizing potential of sediments);
40 pH; biological uptake; and reactivity of the compounds themselves (EPA 1993a). Water circulation is
41 potentially the most important factor in determining the dispersal of contaminants associated with
42 suspended sediments (Bryan 1984). Dissolved constituents are likely to be dispersed by bottom currents.
43 Silt and clay particles, which often are associated with trace chemical constituents, may be dispersed by
44 bottom currents and trapped in topographic lows (for example, in a small submarine canyon to the east).
45 The biological uptake, absorption, and desorption of chemical constituents and their dispersal will,

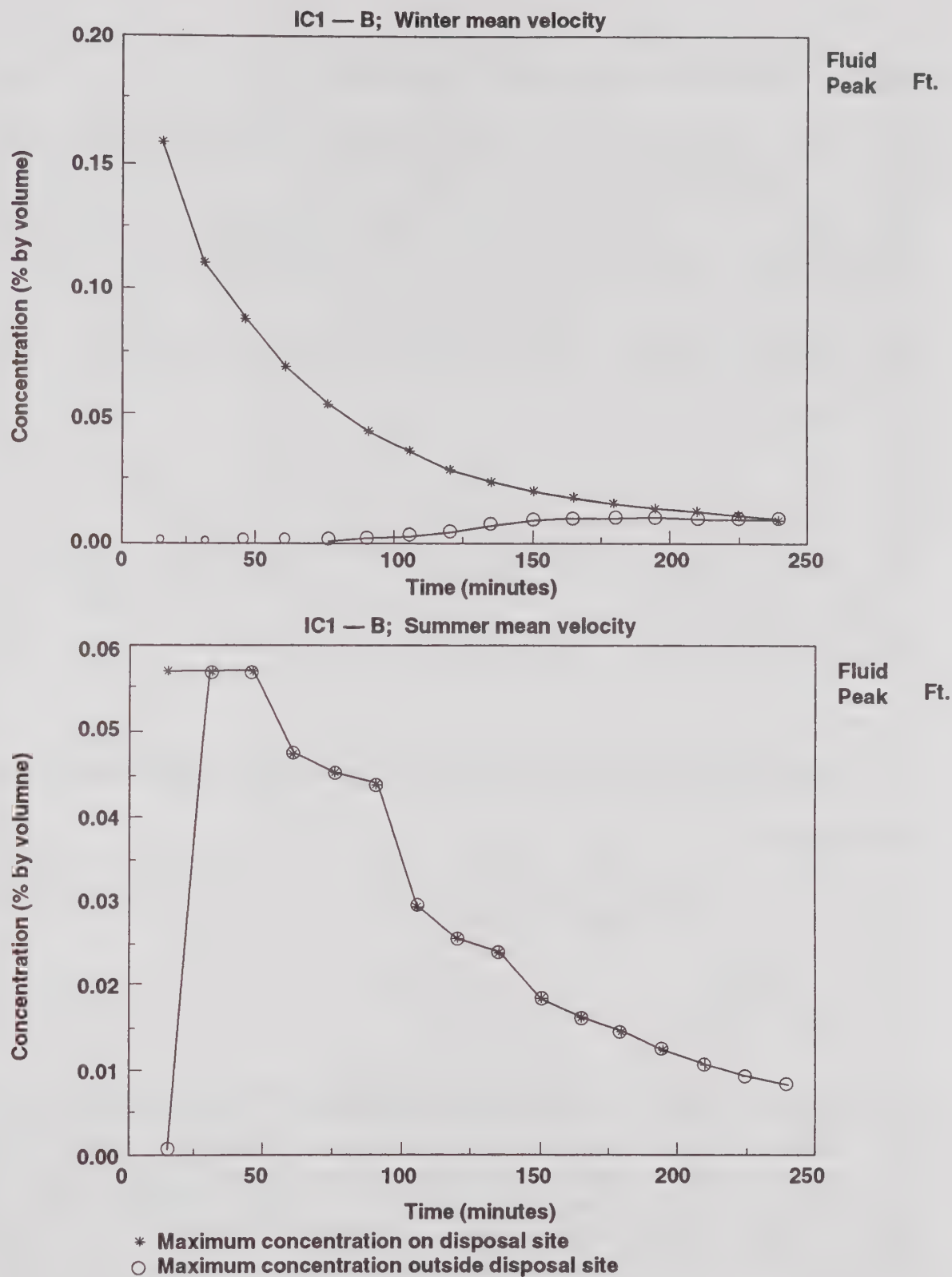


Figure 4.2.7.1-1

**DREDGED MATERIAL CONCENTRATION VERSUS TIME PLOTS FOR DISPOSAL
EVENTS DURING WINTER AND SUMMER CURRENT VELOCITY CONDITIONS AT
THE OCEAN SECTION 102 SITE**

without doubt, take place at the ocean site. However, because only dredged material found suitable for unconfined, open-water disposal through extensive biological testing in accordance with the Implementation Manual will be deposited at Ocean Section 102, significant adverse impacts on site waters by contaminants are not anticipated. Because the lowest suspended phase bioassay LC50 for material to be disposed of at the ocean site is 31.5 percent, a concentration of dredged material in the water column, following disposal, of 0.315 percent (1 percent of 31.5 percent) will meet the LPC requirement of the Implementation Manual. The dispersion modelling conducted by the Corps (1993c) showed that this concentration would not exceed 0.20 percent at any time following disposal, and would not exceed 0.02 percent after four hours of mixing (see Table 4.2.7.1-1). This indicates that disposal of Oakland Harbor dredged material at the ocean site will meet all applicable water quality requirements (COE 1993c).

In accordance with the impact significance criteria for water quality (see section 4.2.4), no significant impacts on the water column at the Ocean Section 102 site are expected. Depletions in oxygen and alterations to total suspended solids, pH, temperature, salinity, and nutrients levels will be short term; ambient waters will replace those affected by the disposal plume, returning water quality parameters to background levels. Impacts associated with the release of contaminants from the dredged material have been predicted by the completion of intensive biological testing of the proposed dredged material. The results of these tests demonstrate compliance with water quality criteria (i.e., the LPC) in accordance with the MPRSA.

GROUNDWATER

No potential groundwater impacts are associated with ocean disposal of dredged sediments (EPA 1993).

Mitigation Measures

No potential significant impacts on the water column are anticipated at the Ocean Section 102 site, consequently, no mitigation measures are warranted.

4.2.7.2 Alcatraz

Impacts on Bay Waters

HYDRODYNAMICS. Among the three in-water disposal sites considered for use in this project, the Alcatraz disposal site experiences the highest current velocities (up to 150 cm/sec in surface waters). The site is considered a dispersive disposal site as long as disposal materials are non-cohesive or if dredged material is slurried prior to placement. The hydrodynamics of Alcatraz and the behavior of dredged material plumes at the site have been well studied (Winzler and Kelly 1985; SAIC 1987; Teeter 1987; Trawle and Johnson 1986; COE 1990); however, the ultimate fate of dredged material deposited at Alcatraz is not known. SAIC predicted that approximately 10 percent of sediments disposed at the site (and dredged via clamshell) would remain entrained in the upper water column and transported off site (SAIC 1987). The "Bay Model" predicts that approximately 47 percent of the material disposed at Alcatraz will exit the Bay through the Gate, and 53 percent will stay in-Bay. Of the 53 percent remaining in-Bay, up to 40 percent of the material (mechanically dredged) is retained at the site itself (SAIC 1987).

Alcatraz has been the location of disposal activity for many years. The predominant hydrodynamic forces felt at the disposal site are local diurnal and semi-diurnal tidal cycles. Currents move in east- and west-

Table 4.2.7.1-1. Maximum Concentrations of Dredged Material in the Disposal Plume Four Hours After Discharge

Depth (m)	MAXIMUM CLOUD CONCENTRATION (MG/L) BY MATERIAL TYPE AND SEASON											
	10 Percent Clump				50 Percent Clump				Mostly Sand			
	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200	0.0	0.0	0.0	0.0	27.4	26.0	22.1	25.9	0.0	0.0	0.0	0.0
250	49.9	47.3	0.0	45.8	40.5	43.1	27.7	41.4	0.0	0.0	0.0	0.0
300	32.8	43.1	44.3	45.8	67.2	16.6	45.2	16.2	0.0	0.0	0.0	0.0
350	82.3	50.0	37.1	63.4	45.9	73.6	82.8	70.2	17.4	0.0	0.0	0.0
400	61.8	76.8	72.8	46.2	26.2	46.4	49.5	47.2	37.1	41.2	18.7	18.9
450	9.8	8.3	35.2	4.0	3.6	3.2	20.9	4.9	61.8	70.7	66.9	67.9
500	2.9	2.7	3.8	2.9	5.8	0.0	2.7	0.0	135.1	113.8	121.1	114.1
550	4.9	4.6	2.7	5.7	0.0	5.4	5.1	5.1	55.9	72.6	137.6	76.0
600	9.0	7.8	5.8	3.0	3.6	3.2	0.0	3.2	44.7	31.8	32.3	32.4
650	0.0	0.0	2.6	0.0	4.3	0.0	2.9	0.1	41.3	23.4	19.8	21.1
700	4.0	0.0	0.0	0.0	4.3	4.2	4.0	4.2	70.8	50.5	41.5	46.6
750	4.0	3.8	2.9	3.6	1.5	0.8	0.6	1.2	0.0	26.1	53.4	26.6
800	1.1	1.0	2.9	0.6	1.5	1.3	1.1	1.2	6.6	0.0	0.0	0.0
850	2.9	1.0	1.0	1.0	2.6	2.4	0.0	2.1	13.7	12.0	10.0	10.1
900	5.4	2.8	4.0	3.9	2.5	0.0	2.6	0.0	2.3	2.2	10.0	6.9
950	3.8	5.1	4.0	1.9	2.5	2.2	1.8	2.2	3.6	3.7	3.2	3.4
1,000	0.0	0.0	1.6	1.9	0.0	0.0	1.8	0.0	13.0	17.0	12.9	14.8
1,050	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.3	17.0	12.9	14.8
1,100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	7.1	15.3	7.3
1,150	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1,200	0.0	0.0	0.0	0.0	0.6	0.4	0.2	0.3	0.0	0.0	0.0	0.0
1,250	0.0	0.0	0.0	0.0	1.3	1.2	0.8	1.3	0.0	0.0	0.0	0.0
1,300	0.2	0.1	0.1	0.2	1.3	1.2	0.8	1.3	0.0	0.0	0.0	0.0
1,350	0.6	0.5	0.1	0.2	0.3	0.2	0.4	0.2	0.0	0.0	0.0	0.0
1,400	0.6	0.5	0.6	0.7	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
1,450	1.9	1.7	0.6	2.0	1.3	1.2	1.3	1.0	0.2	0.0	0.0	0.0
1,500	3.0	1.7	2.0	2.0	1.3	0.0	1.3	0.0	0.2	0.2	0.1	0.2
1,550	3.0	2.8	2.0	1.2	1.3	1.2	1.1	1.2	0.5	0.2	0.1	0.0
1,600	0.2	0.1	1.0	1.2	1.3	1.2	1.1	1.2	0.5	0.6	0.5	0.5
1,650	0.0	0.0	1.0	0.0	0.0	0.0	1.1	0.0	0.7	0.6	0.5	0.5
1,700	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.3	0.6	0.3
1,750	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.3
1,800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,850	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1,950	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: U.S. Navy 1993.

trending directions with a slight northwest-southeast component. These current patterns have not changed at Alcatraz and are not expected to change with use of this site for the Oakland Harbor dredging project. Mounding can create slight alterations in local current patterns where water parcels must move over and around the mound. Current velocities accelerate somewhat as water passes over the peak. Controls are in place to minimize mounding at the site which has occurred in the past and creates hazards to navigation. Controls described in Public Notice (PN) 93-3 issued by the Corps, San Francisco District, include maximum disposal volume targets for 30-day time periods (400,000 cy per month October to April, and 300,000 cy per month May to September). Limitations are also noted for those materials dredged by clamshell bucket which have a tendency to mound (PN 93-3). Materials dredged by clamshell are disposed in clumps. Clumped material descends rapidly to the bottom where it remains largely unaffected by local currents.

With the present management actions in place (i.e., PN 93-3), significant impacts on hydrodynamics in the vicinity of the Alcatraz disposal site are not anticipated.

WATER QUALITY. Water quality parameters potentially impacted by the disposal of sediment at the Alcatraz disposal site include suspended solids, dissolved oxygen, nutrients, salinity, temperature, pH, and concentrations of dissolved contaminants. The dispersive nature of Alcatraz will ameliorate the effects of disposal on these parameters due simply to the site's ability to quickly replace affected waters with ambient site waters. Background levels of each parameter are expected to return within minutes of disposal.

Corps-sponsored studies of water column impacts at the Carquinez disposal site documented minimal, short-term variations in pH, salinity, and temperature during disposal. The Carquinez site is located in an area where current velocities are less than 1 cm/sec. Water quality effects noted at this site represent conservative changes in comparison to Alcatraz. Ambient concentrations of pH, salinity, and temperature were regained usually within 10 minutes following material release at Carquinez. Measurements of pH varied less than 0.10 units; salinity decreased by no more than 2 parts per thousand; and temperature varied less than 1°F. These short-term alterations are well within the surface water quality objectives stipulated by the RWQCB (1986) (see section 3.2.1.5). Dissolved oxygen concentrations were observed to decline by up to 6 mg/l in bottom waters within the Carquinez disposal plume (COE 1976, Appendix C). It is unlikely that dissolved oxygen would decline by this magnitude at Alcatraz, given the high energy environment experienced there. The exception to this may be dissolved oxygen concentrations encountered during disposal operations at slack water. Minimum dissolved oxygen concentrations of 5 mg/l have been set by the RWQCB (1986). A mean ambient dissolved oxygen concentration of almost 8 mg/l is common in Central Bay waters (COE 1976, Appendix C). Any depression in dissolved oxygen concentration would be short term (less than 3 minutes) and nearfield, with minimal impacts.

For the same reasons discussed above, dredged materials containing elevated levels of nutrients concentrations will become rapidly diluted at Alcatraz. Nutrients may increase somewhat in the vicinity of the dredged material plume, stimulating primary production. On the other hand, decreased light transmittance caused by elevated turbidity levels will depress phytoplankton production. No significant impacts are expected.

Concentrations of total suspended sediments will unavoidably increase during disposal events at Alcatraz. SAIC tracked disposal plumes for 11 different disposal events during different tidal cycles. Disposal plumes usually dissipated within 10 to 15 minutes of disposal. Concentrations of total suspended

sediments ranged from 44 to 165 mg/l in the lower water column. Background levels ranged from 9 to 17 mg/l. In one disposal event, a plume was tracked for 20 minutes, at which time suspended sediments measured 80 mg/l; however, this event was an exception to otherwise rapidly dispersed plumes. This disposal event was monitored during high velocity currents. It was suggested that the fast currents combined with a large disposal volume maintained the material in suspension longer (SAIC 1987). In a study performed by MEC (1990), suspended solids concentrations during disposal were 86 mg/l at surface; 38 mg/l at 9 m; and 44 mg/l at 12 m. Background levels ranged from 6 to 22 mg/l.

As noted in the previous section for the ocean site, biological effects to fishes (with the exception of the alewife) have not been noted for concentrations of suspended solids below 500 mg/l. Demersal eggs or life history stages that are sessile are more susceptible to elevated sediment load (Lunz et al. 1984). Additional data relating biological effects of suspended sediments were presented in Peddicord et al. (1975) and Morgan et al. (1973). Many of their test species were native to San Francisco Bay. These studies demonstrated that most test species were tolerant of high suspended sediment concentrations for long periods of time (see section 4.2.6.1). Suspended solids concentrations are not expected to cause significant impacts at Alcatraz.

Biological uptake, adsorption, and desorption of contaminants associated with the suspended dredged material will occur at Alcatraz. However, significant impacts are not expected, because only materials in compliance with applicable water quality requirements will be disposed of at the Alcatraz site (see section 4.2.4). The reasons for this are described for the ocean site where concentrations of dredged material in the water column after disposal of 0.315 percent will meet the LPC requirement. For the Alcatraz site, modelling to determine compliance with the LPC requirement had not been completed at the time of publication of the Draft SEIR/S. Several input parameters regarding physical conditions at the site have not yet been determined. The results of this analysis and the implications for water quality impacts at the site will be presented in the Final SEIR/S.

Significant impacts on the water column are not expected at Alcatraz, given compliance with water quality standards. Alterations to standard water quality variables will be short in their duration. Proposed dredged material found suitable for unconfined, open-water disposal, based on intensive testing both chemically and biologically, is in compliance with LPC requirements. Water quality criteria established by the RWQCB in the Basin Plan are not expected to be violated.

GROUNDWATER

No potential groundwater impacts are associated with in-Bay disposal of dredged sediments (PTI 1989; COE 1979, 1988).

Mitigation Measures

Although no significant impacts on the water column are expected at the Alcatraz disposal site, standard material placement controls should be in place. These include accurate positioning and logging procedures and spot inspections. All controls described in PN 93-3 should be implemented to avoid potential navigation hazards caused by mounding of dredged material.

4.2.7.3 Bay Farm Borrow Area

Impacts on Bay Waters

HYDRODYNAMICS. As noted in previous sections, circulation patterns in and adjacent to dredged material disposal sites will influence the dispersion and long-term fate of dredged material released at each site. The Bay Farm Borrow Area (BFBA) is no exception. Recent studies performed at the BFBA have included current velocity measurements collected on the shallows surrounding the excavated pit. Near-bottom flow rates are on the order of 20 to 25 cm/sec north of the pit and 25 to 40 cm/sec south of the pit. Waters move west-northwest and east-southeast during ebb and flood, respectively. Current velocities within the pit are slower than those measured on the fringes of the pit. Flows there slow to 15 cm/sec or less, indicating the pit is presently depositional in nature.

The potential deposition of dredged material in the borrow area is expected to alter current speeds within the excavated pit itself. Neither current direction or current speed on the fringes of the borrow area are expected to change substantially. If confined disposal is exercised at the BFBA, the capping plan specifies the placement of approximately 11 feet of material (unsuitable material plus cap), changing the present average depth within the pit from -32 feet to -21 feet. The plan also includes the placement of two containment dikes, one on the northern side of the pit and one in the southeast corner of the site. Water flowing over the containment dikes will increase somewhat, but then decrease once deeper water is encountered. Sediments in suspension will deposit in topographic lows.

The area will remain depositional due simply to the physical depression remaining even after disposal and cap placement. Present design specifications for the BFBA confined aquatic disposal site does not include potential disposal that would equal or exceed the site's capacity. If the site is used for unconfined disposal of suitable material alone, total volumes disposed in the pit will be lower (by roughly one-fourth) than those for the confined aquatic disposal design. Consequently, disposal mounds commonly found at other shallow dredged material disposal sites and which alter current velocities and direction will not occur at the BFBA.

Bottom erosion of unconsolidated sediments around the periphery of the pit itself is possible with current velocities of 20 cm/sec or more. Materials resuspended as a result of ambient currents or wind and wave action may be carried into the borrow pit or in a east-southeast or west-northwest direction. These circulation patterns will affect the dispersion of dredged material during disposal and capping operations and, ultimately, the water quality of surrounding waters. Local hydrodynamics at the BFBA, however, are not expected to change significantly during or after dredged material disposal.

WATER QUALITY. Water quality parameters potentially impacted by dredged material disposal and cap placement operations have been identified in previous sections (see section 4.2.7.1, 4.2.8.1). Impacts on these parameters can be inferred from data collected during disposal events at Northern reach disposal sites (COE 1976, Appendix C). It was noted in these Corps studies that changes in pH, salinity, temperature, and dissolved oxygen to site waters were localized and short in their duration. Ambient concentrations of these parameters were regained usually within 10 minutes following material release. It is anticipated that, based on studies performed by the Corps at in-Bay sites, pH will vary less than 0.10 units; salinity will decrease by no more than 2 parts per thousand; and temperature will vary less than 1°F. These short-term alterations are well within the surface water quality objectives stipulated by the RWQCB (1986) (see section 3.2.1.5). During these same studies dissolved oxygen concentrations were

observed to decline by up to 6 mg/l in bottom waters within the disposal plume. Depressions in dissolved oxygen concentrations of this magnitude may violate the minimum requirements of 5 mg/l (set by the RWQCB) for disposal operations performed during the summer months. Ambient dissolved oxygen levels have been recorded as low as 6.04 mg/l (with a maximum of 9.64 mg/l, mean = 7.88 mg/l) in waters measured in the pit (see section 3.2.4.3). The lowest recorded dissolved oxygen concentration within the pit was measured in August of 1992, and, in general, lowest dissolved oxygen concentrations were observed in late spring and summer among all sampling locations. As such, potential significant short-term impacts on the water column at the BFBA are possible for disposal operations performed in the summer months.

Potential increases in nutrients levels will be restricted to the discharge plume and may enhance primary production, and consequently increase turbidity levels. Turbidity will, overall, be increased by dredged material suspended in the water column, minimizing the relative role of nutrients increases. These effects are expected to be ephemeral and insignificant in terms of impacts (see section 4.2.7.1).

Increased total suspended solids concentrations will unavoidably occur at the BFBA during disposal activities. The behavior of dredged material during disposal and its impacts on the water column were studied by the Corps in San Francisco Bay in 1974. Silty clay to clayey silt was discharged from twin hoppers at the Carquinez Straits disposal site and monitored for several water quality parameters including suspended solids. These field measurements represent a conservative view of potential impacts at the BFBA because current velocities are slower at the Carquinez site (less than 1 cm/sec) than local BFBA velocities, resulting in faster dispersion of suspended solids at the BFBA. Concentrations of dredged material were in the range of grams per liter in surface waters (top 7 ft.), while concentrations near bottom exceeded 300 mg/l for short periods of time. Peak concentrations typically dissipated within 10 minutes following release (COE 1976 Appendix C).

Ambient suspended sediment concentrations at the BFBA have ranged from 2.1 mg/l to 120 mg/l. The lowest values were measured during late fall, while the highest were measured during the summer months (see section 3.2.4.3). Because elevated total suspended sediment concentrations are expected to be transient and the contribution of this suspended dredged material is minuscule with respect to the Bay's overall sediment load, impacts at the BFBA will be insignificant. This will satisfy the water quality objective for suspended solids set by the RWQCB. Beneficial uses of the waters in the vicinity of the BFBA will not be adversely affected.

Dispersion modeling using the DIFID module of STFATE was performed for materials proposed for disposal at the BFBA. The model predicted that at no time would the concentration of dredged material in the water column exceed 0.315 percent (COE 1993b). The model also predicted that during certain tide conditions in portions of the site, low concentrations of dredged material would be present outside of the disposal site boundary. These concentrations may exceed the 0.315 percent limit if material placement is performed in the extreme southeast corner when current velocities exceed 1.15 feet per second. Exceedances would not be encountered if material placement is conducted at least 400 feet from the edge of the deep pit area (i.e., the southeast corner), or if material placement is conducted when current velocities in the vicinity of the BFBA do not exceed 1.15 feet per second.

Based on the available information, impacts on the water column due solely to elevated total suspended solids (TSS) concentrations are unlikely. However, increased TSS concentrations caused by disposal

operations may potentially be accompanied by the significant depletion of dissolved oxygen (discussed previously) and the release of pollutants.

Disposal of materials found unsuitable for in-Bay disposal in accordance with the CWA and PN93-2 may be placed in the borrow pit of the BFBA. If this alternative is exercised, the present design plan is to build cells that hold unsuitable sediments that can be dredged in a 30-day period, cap each cell with suitable material, and then continue to fill adjacent cells with unsuitable material. The "walls" of these cells would be constructed from suitable materials. The initial cap would be relatively thin but thick enough to effectively isolate contaminated material for a period of a few years. Approximately 150,000 cubic yards of unsuitable material could potentially be dredged in a period of 30 days. The area of each cell would be 942,000 square feet or 21.6 acres. Since the pit is about 400 acres in size, there would be approximately 19 or 20 cells. At the end of the project, the entire area of cells would be covered with a 7- to 8-foot thick layer of suitable cap material. The use of cells in this design limits the amount of time the materials found unsuitable for unconfined, open-water disposal are exposed to the water column, which limits the impacts associated with the potential release of contaminants to the water column. If capping is not exercised at the BFBA, 4.8 mcy of suitable material will be disposed at the site. In either disposal alternative, the bottom elevation would not increase above -20 feet MLLW. For depths greater than the -20 foot threshold, bottom sediments would be resuspended less than 10 percent of the time and perhaps as little as 1 percent of the time (COE 1992b).

Both the suitable and unsuitable material planned for disposal at the BFBA were found to be in compliance with the LPC of 0.315 percent, as discussed in section 4.2.3 (COE 1993b). This indicates compliance with water quality standards (and water quality objectives of the RWQCB). The use of cells in the confined aquatic disposal design limits the amount of time contaminated sediments are exposed to the water column, while the elevation of the dredged material deposit will remain below the projected sediment resuspension threshold of -20 feet MLLW. The sediment cap is expected to be stable. Therefore, significant impacts caused by the release of toxic pollutants to the water column are not expected.

With the possible exception of temporary degradation of dissolved oxygen concentrations, potential water column impacts on site waters at the BFBA caused by dredged material placement are not expected. Mitigation to avoid significant reductions in dissolved oxygen may be warranted.

GROUNDWATER

No potential groundwater impacts are associated with in-Bay disposal of dredged sediments (PTI 1989; COE 1979, 1988).

Mitigation Measures

Placement of dredged material unsuitable for unconfined aquatic disposal at the BFBA has the potential for the short-term depletion of dissolved oxygen and the release of contaminants to the environment. The following mitigation measures should be in place to reduce these potential impacts to insignificance.

Mitigation measures required to avoid exceedances of the LPC beyond BFBA site boundaries include the following:

Material placement can take place during any expected current velocity, provided the material is placed at least 400 feet from the edge of the disposal pit boundary.

Material placement can take place in the extreme southeast corner of the BFBA as long as current velocities are not exceeding 35 cm/sec during disposal.

Control material placement to ensure Basin Plan dissolved oxygen levels are met.

Contaminated material should be transported from the dredge site to the disposal site by bottom-dump haul barge.

Contaminated sediment excavated by clam shell from the haul barge will not be allowed to overflow during dredging or in transit to the site.

Full haul barges will not be allowed to stand by for periods of time greater than 24 hours.

Release of contaminated material will be instantaneous below the water surface within the target area.

Dump position should be established by an electronic positioning (i.e., DGPS and/or GPS) system capable of ± 3 m accuracy.

Dump position logs (i.e., DDLS) should be maintained and routine inspections performed.

Bathymetric surveys will be performed monthly during placement, then twice yearly for 2 years, and then yearly in the long term.

The placement of capping sediment must also be controlled to ensure even coverage over the extent of the unsuitable material. The following mitigation measures will be in place:

Minimize the elapse of time between completion of contaminated material placement and capping.

Utilize cap placement methods (i.e., slow release) to avoid resuspension of contaminated material.

Apply uniform layers of cap material to ensure adequate coverage.

Electronic positioning and logging procedures will be in place, identical to the contaminated material placement operations.

4.2.7.4 Leonard Ranch/Redwood Landfill

Leonard Ranch Rehandling Option

With appropriate management and controls, Leonard Ranch Rehandling Option would result in no significant impacts on surface and groundwater.

IMPACTS ON GROUNDWATER

If no cell liner or leachate collection system is used, the primary impact to groundwater in the initial stages of sediment drying at the Leonard Ranch site would be a local increase in the hydraulic head. This could result in infiltration of slurry makeup water and pore water from the dredged sediments into groundwater. Once slurry and pore water have drained from the sediments, rain falling on and infiltrating through the sediments could also leach soluble constituents into groundwater. These dissolved and leached constituents could adversely impact groundwater quality beneath the rehandling site. However, this is unlikely because (1) essentially impermeable bay muds underlie the site, (2) significant leaching by rainwater of the silty, generally low permeability, dredged sediments is not expected during the few years the sediment will remain on site, and (3) the existing shallow groundwater quality is already brackish. Thus, the potential for infiltration of significant amounts of leachate and pore water and corresponding impacts on water quality is considered minimal. Over the 30-year life of the facility, depending on the duration and frequency of dredged sediment disposal from other projects, the cumulative infiltration of pore water and leachate may be significant enough to sustain long-term changes in on-site groundwater flow conditions and groundwater quality. Currently, lateral flow conditions exist at the site, which causes groundwater to flow from the proposed rehandling site toward the northeast. If rehandling projects involve large volumes of sediment, following each other in rapid succession, and are of long disposal duration, shallow groundwater flow directions may be altered due to sustained increases in on-site hydraulic head conditions. This may direct fluids off site. Once off site, any impacted groundwater would be expected to flow eventually toward the bay as presumed regional flow patterns are likely to direct groundwater to the south. Most likely, sufficient time will elapse between disposal projects to allow for reestablishment of pre-disposal on-site groundwater flow conditions. If a cell liner or leachate collection system is used, impacts on groundwater beneath the site would not be expected.

To further evaluate potential groundwater quality impacts, the capacity of the underlying bay mud to attenuate the concentrations of constituents in the subsurface was evaluated. Bay mud is capable of adsorbing constituents on organic and clay particles. In the process of adsorption, the relative concentration of a constituent is reduced, e.g., attenuated. This analysis followed protocols developed by the RWQCB for estimating subsurface attenuation factors at Class III landfills.

The RWQCB has developed five basic criteria for determining attenuation factors for Class III Landfills in Region 2 (RWQCB 1992). Different attenuation factors are established for the manner in which each criterion is satisfied by site conditions. The only criterion that leads to an attenuation factor at Leonard Ranch is the presence of fine-grained materials at the site including both existing subsurface materials (bay muds) and the dredged sediments themselves. The Leonard Ranch site is underlain by clay to depths of at least 15 feet. Groundwater in these shallow clays ranges from 5 to 14 feet below the ground surface. According to these site characteristics, attenuation factors of 200 for inorganics and 100 for organics would be appropriate for Leonard Ranch, following the RWQCB methodology. No attenuation factors are appropriate for dissolved inorganic parameters such as TDS, chloride, and sulfate because these constituents are not adsorbed by subsurface materials.

Following RWQCB methodology, potential water quality impacts may be evaluated by comparing leaching test data to water quality goals, modified by attenuation factors and the characteristics of the predictive tests. These modified water quality goals are termed acceptance limits, or in the terminology of Marshak (1991), designated levels.

Tables 4.2.7.4-1 and 4.2.7.4-2 present the lowest freshwater or marine water quality objectives applicable to the receiving groundwater or surface water in the vicinity of Leonard Ranch. Since groundwater is brackish at the site, MCLs for groundwater were not used in the analysis. Also presented are the highest mean concentrations for each of the predictive tests completed on Inner and Outer Harbor and Turning Basin sediments that reflect potential leachate concentrations (the WET/TCLP, kinetic batch, sequential batch, rainwater extraction, and pore water tests; HLA 1993a). For each of these tests, acceptance limits are calculated differently depending on the attenuation factors established for the site and the specific test dilution factors. Dilution factors include 10 for the WET, 20 for the TCLP, 4 for the kinetic and sequential batch, 10 for the rainwater extract and 1 for pore water. Values in bold indicate leachate test data that exceed an acceptance limit, indicating the potential for a water quality goal exceedance.

For the WET/TCLP tests, cadmium, copper, lead, mercury, nickel, and zinc test results exceeded the material acceptance limits. However, as discussed by HLA (1993a), WET/TCLP tests do not reflect the likely leachate quality expected at Leonard Ranch because the standard test protocol calls for use of buffered acid leaching solution rather than a fluid similar to rainwater, the leaching fluid expected at Leonard Ranch. In upland environments, the pH of dredged sediments may drop as natural sulfides in the sediments are oxidized during the drying process and acid is created. Past experience with Phase I Port sediment disposed and dried in upland environments (HLA 1991; Patrick 1990) has not shown substantial pH drops. Likewise, predictive tests (rainfall simulator/lysimeter and sequential batch tests) completed on 42-foot project sediments indicate sediment pH ranges from 6.88 to 8.29 in wet (anaerobic) sediments and 6.1 to 9.8 for dry (aerobic) sediments (section 4.2.2). At these sediment pHs a relatively dilute, neutral leaching fluid would be expected. Additional anaerobic leachate testing performed by Lee et al. (1993) indicated that all water quality standards will potentially be met for both Oakland Inner and Outer Harbor sediments with the exception of arsenic, tributyltin, and mercury discharged to receiving waters. In addition, after the sediment dried out, leachate test results indicated that leachate arsenic, cadmium, copper, mercury, zinc, and tributyltin potentially may exceed receiving water quality standards.

Regardless of the character of leachate, if leachate is released into the subsurface and discharged to on-site surface water bodies, considerable dilution both within groundwater, site surface water, and at the point of discharge beyond the site boundaries is expected. A less-than-tenfold reduction in the WET/TCLP leachate is sufficient to meet the acceptance criteria for these parameters and, consequently, the water quality goal. Such a reduction is likely in the shallow subsurface and surface waters within the boundaries of the Leonard Ranch site based upon the expected small volume of leachate relative to the much larger volume of groundwater and surface water at the site. Thus, this potential impact is not considered significant. Tributyltin results were slightly above the material acceptance limit (which takes into account subsurface attenuation) developed for the kinetic/sequential leachate and rainwater extraction tests. This is not considered significant since only a slight amount of dilution of any leachate that migrates from the dredged material into surface water and groundwater (within the boundaries of the site) would be required to meet the water quality objective for tributyltin at the site boundary.

Finally, lead, manganese, TDS, chloride, and sulfate values from the rainwater extraction test, lead values from the kinetic/sequential leach tests, and chloride and sulfate values from the pore water test exceeded their acceptance limits. A small amount of dilution within the site boundaries is all that would be required to meet the lead and manganese acceptance limits. Because existing shallow groundwater is generally saline, and hydrostatically isolated from deeper, possibly higher quality groundwater by a layer of impermeable bay mud, this potential exceedance for salts (TDS, chloride, and sulfate) is not significant. According to a nearby resident (telephone conversation, HLA 1993a), one well exists on

Table 4.2.7.4-1. Comparison of Test-Specific Acceptance Limits to Leachate Test Results
Leonard Ranch Rehandling Option
(page 1 of 2)

<i>Parameter</i>	<i>Lowest Freshwater or Marine Objective¹</i>	<i>WET/TCLP Acceptance Limit[*]</i>	<i>WET/TCLP Highest Mean Value¹</i>	<i>Kinetic/ Sequential Leachate Acceptance Limit^{**}</i>	<i>Kinetic/ Sequential Leachate Highest Mean Value¹</i>	<i>Rainwater Extraction Acceptance Limit^{***}</i>	<i>Rainwater Extraction Highest Mean Value⁴</i>	<i>Pore Water Acceptance Limit^{****}</i>	<i>Pore Water Highest Mean Value⁴</i>
Metals (µg/l)									
Arsenic	36	720	110	1,800	72.1	720	9	7,200	43.5
Cadmium	0.66	13.2	85	33	1.7	13.2	2	132	1.3
Chromium (total)	210	4,200	670	10,500	64.8	4,200	< 10	42,000	3.7
Copper	2.9	58	120	145	102.5	58	4	580	46
Lead	1.3	2.6	700	6.5	43.2	2.6	8	260	50
Mercury	.012	0.24	3	0.6	0.09	0.24	< 0.2	2.4	0.14
Nickel	8.3	166	430	415	54.6	166	16	1,660	20
Zinc	59	1,180	1,600	2,950	104.2	1,180	8	17,200	49
Iron	1,000	20,000	--	50,000	--	20,000	16,200	11,800	208
Manganese	--	--	--	2,500	--	1,000	1,180	10,000	1,643
Selenium	5.0	100	--	250	--	100	--	1,000	--
Silver	2.3	46	9.5	115	--	46	--	460	--
Inorganics (mg/l)									
TDS	--	50	--	125	--	50	1,384	500	--
Chloride	--	25	--	62.5	--	25	759	250	9,633
Sulfate	--	25	--	62.5	--	25	35	250	737

Table 4.2.7.4-1. Comparison of Test-Specific Acceptance Limits to Leachate Test Results
Leonard Ranch Rehandling Option
 (page 2 of 2)

<i>Parameter</i>	<i>Lowest Freshwater or Marine Objective¹</i>	<i>WET/TCLP Acceptance Limit*</i>	<i>WET/TCLP Highest Mean Value²</i>	<i>Kinetic/ Sequential Leachate Acceptance Limit**</i>	<i>Kinetic/ Sequential Leachate Highest Mean Value³</i>	<i>Rainwater Extraction Acceptance Limit***</i>	<i>Rainwater Extraction Highest Mean Value⁴</i>	<i>Pore Water Acceptance Limit****</i>	<i>Pore Water Highest Mean Value⁵</i>
Organics (µg/l)									
PCBs	--	0.00078	--	0.00175	--	0.00078	--	0.007	--
DDT	--	0.006	--	0.015	--	0.006	--	0.06	--
PAHs	0.031	.155	<10	0.775	0.1938	0.155	--	3.1	--
TBT	.005	0.05	0.0299	0.125	0.1687	0.05	0.0901	0.5	0.173

Notes: * AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 10 for WET and 20 for TCLP

** AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 4

*** = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 10

**** AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 1

WQO = Lowest freshwater or marine objective

AF = Attenuation factor

DF = Dilution factor

AL = Acceptance limit

1 = See Tables 3.2.1-1 and 3.2.1-2

2 = See Table K-6

3 = See Tables K-7 and K-8

4 = See Table K-9

Values in bold exceed the acceptance limit

Source: Lee et al. 1992 and 1993.

**Table 4.2.7.4-2. Modified Elutriate and Surface Runoff Test-Specific Dilution Factors Necessary to Meet Water Quality Objectives
Leonard Ranch Rehandling Option**

<i>Parameter</i>	<i>Lowest Basin Plan Marine Objective</i>	<i>ELUTRIATE HIGHEST MEAN VALUE¹</i>		<i>Dilution Factor to Meet Water Quality Objective+</i>	<i>Surface Runoff (Filtered) Highest Mean Value</i>	<i>Dilution Factor to Meet Water Quality Objective</i>
		<i>Dissolved</i>	<i>Total</i>			
Metals (µg/l)						
Arsenic	36	3.97	4.958	/a/	8.58	/a/
Cadmium	9.3	0.2867	0.095	/a/	0.444	/a/
Chromium (total)	-	3.688	3.993	-	1.89	-
Copper	2.9	33.6	2.34	11.5	5.99	2.0
Lead	5.6	17.317	19.9	3.1	0.891	/a/
Mercury	2.1	0.0407	0.008	/a/	0.047	/a/
Nickel	8.3	4.66	--	/a/	--	--
Zinc	86	45.9	12.08	/a/	33.9	/a/
Selenium	5.0	--	--	--	--	--
Silver	2.3	0.0267	--	/a/	1.08	/a/
Organics (µg/l)						
PAHs	15	0.0468	--	/a/	--	--
TBT	0.04	0.24	0.0256	6	0.096	2.4

Notes: a. Below lowest marine basin plan shallow marine water effluent limitations without dilution.
+ Largest dilution factor required to meet water quality objective for either dissolved or total measurement.

Source: Lee et al., 1992 and 1993; see also Tables K-4 and K-5.

Leonard Ranch rehandling site and two others to the north and south (one south of the railroad line [on Sonoma Baylands], one south of SR 37, and one north of SR 37). The well on Leonard Ranch is currently being used for washing and non-consumptive purposes and the other two are either not used and/or lost; all were noted as being brackish. Saline pore water/leachate is not expected to impact the current brackish water conditions.

At the off-loading facility and along the footprint of the slurry pipeline, no impacts on groundwater are expected. This is because the slurry will be contained within the pipe and off-loaded directly from barges in San Pablo Bay.

IMPACTS ON SURFACE WATER

The addition of a confined disposal area at the Leonard Ranch site will cause changes in the direction of surface runoff. Interior drainage is presently directed across the site by man-made earthen ditches that discharge into perimeter channels around the Leonard Ranch site. After the addition of dredged material, on-site runoff will be altered to flow to a single point of discharge at an existing 30-inch corrugated metal pipe on the southern property boundary (see Figure 3.2.4.4-4). This corrugated metal pipe will direct the on-site surface drainage and the decant and effluent water into the existing perimeter channel that drains toward the existing pump station in the southwestern corner of the adjacent Sonoma Baylands site. This pumping station, located at the terminus of the channel, discharges flow through a pipe into the Petaluma River.

Discharges to the corrugated metal pipe beneath the railroad right-of-way will be controlled and monitored by site operations. Releases from the effluent control basin will be controlled by the use of a weir spillway board to be located upstream of the inlet to the 30-inch corrugated metal pipe. These weirs will control the outflow from the dredged material containment area and effluent water control basin until almost all fine-grained sediment from the dredged materials settles out. Erosion and sedimentation controls as well as best management practices (BMP) in conformance with the conditions of the NPDES General Permit for construction and post-construction activities will be utilized to control the quality of stormwater runoff, which cannot drain toward the control basin. Consequently, no long-term effects on sedimentation rates in the river or bay are expected.

The quality of the effluent from the dredged material containment ponds and weirs will be sampled and monitored prior to discharge into the San Pablo Bay. The use of the containment area weir, the effluent water control basin, and stormwater erosion and sedimentation BMPs should result in release water meeting water quality standards. If the basin and these measures prove not to be completely effective, the effluent water will be recycled into the off-loading slurry water and could be treated prior to discharge into the Petaluma River.

The results of the modified elutriate test indicate that when the highest mean value of the samples were compared to the lowest Basin Plan shallow marine water effluent limitations (Table 4.2.7.4-2), the only potential impact from elutriate water is for copper, lead, and tributyltin for sediments from the Inner and Outer Harbors and the Turning Basin. Because discharges to adjacent surface waters will be controlled by site operations until the on-site waters meet discharge standards, the project design will eliminate any potential impacts that could occur by the release of elutriate water into San Pablo Bay. Retention of suspended particulates within the drying cells and the Control Basin will remove the bulk of constituents that may affect surface water quality. Dissolved constituents observed in the modified elutriate test data

may require some dilution to meet water quality standards. Dilution factors of less than between 11.5 and 3.31 for the concentrations of copper and lead are required to meet the lowest freshwater or marine water quality standard. These factors are likely to be readily attainable within the on-site Control Basin which discharges surface waters from the facility. A dilution factor of about 6 for the concentration of tributyltin may be required to meet the applicable standard. As discussed below, long retention times in the Control Basin will likely allow time to degrade the tributyltin.

The results of simulated runoff tests (Table 4.2.7.4-2) indicate that, relative to the lowest marine water quality objective, potentially significant water quality impacts for copper and tributyltin could be expected if storm water runoff is released, ignoring dilution by receiving waters. Dilution factors of 2 and 2.4 (respectively) would be required to meet these standards. The project design, which incorporates the effluent water quality control basin to regulate release of particulates, storm water erosion and sedimentation BMPs, and a monitoring and inspection program of the site discharges, will eliminate the potential release and impact of contaminants in surface runoff upon adjacent surface waters. The long retention time in the control basin will allow sufficient time to microbially and chemically degrade any tributyltin present in the surface runoff. Tributyltin has been shown to degrade in estuarine waters in 3 to 13 days (Lee et al. 1989).

Since makeup water from San Pablo Bay would provide most of the effluent (80 to 85 percent of the incoming slurry), the expected salt concentration in the effluent would be similar to that at the nearby discharge point in San Pablo Bay, even with any salt contributions from the dredged sediments. No significant impact is expected.

The existing site lies within a FEMA Zone VI flood hazard designation area and is potentially subject to coastal flooding, high tides, and overbank flooding from the Petaluma River. Preservation and maintenance of the existing levees and dikes surrounding the site will protect project operations from having significant impacts on the flooding potential of the area.

At the off-loading facility in San Pablo Bay, intake pipes for the slurry makeup water will be positioned a short distance below the water surface. This will prevent entrainment of bottom sediment and limit significant increases in turbidity in the water column due to removal of bay water. During off-loading, sediment may be released to the Bay. Best management practices will be applied to limit the release of sediment to surface water. No significant impacts on surface water are expected at the off-loading site.

With appropriate management, no significant impacts on the surface water quantity, quality, or flooding potential in the vicinity of the site are anticipated.

IMPACTS ON DRINKING WATER SUPPLIES

Surface water and shallow groundwater are predominantly saline and not potential sources of drinking water, as defined by the SWRCB guidelines. This is confirmed by the presence of brackish-to-saline water at on-site and nearby wells and piezometers (section 3.2.4.4). However, existing domestic supply wells at the Leonard Ranch house are upgradient (i.e., upstream of the regional direction of groundwater flow) of the site. If the wells draw water from the shallow fresh groundwater and if significant pumping from the one or more wells occurs over an extended period of time, the disposal may impact these local domestic water supplies. However, the essentially impermeable bay muds underlying the site would

1 inhibit infiltration to deeper, potentially fresher groundwater aquifers. If the domestic wells are drawing
2 water from a deeper aquifer, sediment disposal is unlikely to impact these local domestic water supplies.
3

4 The existing well at the Leonard Ranch house is used for washing and other non-consumptive purposes
5 only. It is likely that if the rehandling facility is built, the use of the house and adjacent well would be
6 eliminated or changed to a part of the facility operation.
7

8 MITIGATION MEASURES 9

10 Significant impacts on surface and groundwater water quality are not expected to occur due to the existing
11 poor quality of surface and groundwater. Therefore, mitigation measures will not be required since no
12 significant impacts are anticipated. However, because relatively high concentrations of TPH as gasoline
13 have been detected in shallow soil beneath a former on-site fuel storage tank, further investigations will
14 be required to assess the extent of and need for remediation of TPH in soil and, potentially, groundwater.
15 If remediation is required, the appropriate parties will conduct the remediation.
16

17 *Redwood Landfill Disposal Option* 18

19 No significant impacts on surface and groundwater are expected at Redwood Landfill, due to the
20 requirements of Redwood's operating permits.
21

22 IMPACTS ON GROUNDWATER AND SURFACE WATER 23

24 Impacts on groundwater and surface water at Redwood Landfill are addressed by Redwood's operating
25 permits.
26

27 Redwood Landfill currently accepts dredged sediment for daily cover and levee restoration. Acceptance
28 criteria are based on the completion of bulk chemistry testing, and, if necessary, the completion of
29 extraction tests using the WET methodology with substitution of distilled water for the acidic WET
30 leaching fluid. If samples pass the daily cover/levee restoration sediment screening criteria, they are
31 considered acceptable without additional testing. If they fail, leaching tests are required (Redwood
32 Landfill 1993). These testing requirements and acceptance standards are currently being negotiated with
33 the RWQCB.
34

35 Based on the comparison in Table 4.2.7.4-1, Redwood Landfill would require additional leaching tests
36 for Oakland Inner and Outer Harbor and Turning Basin sediments. Because such tests have not been
37 completed, it is unclear if Port of Oakland sediments would be acceptable for levee restoration or daily
38 cover. If this disposal option is selected, testing for acceptability of sediments for Redwood will be
39 accomplished pending resolution of testing requirements and acceptance criteria between Redwood
40 Landfill and the RWQCB.
41

42 IMPACTS ON DRINKING WATER SUPPLIES 43

44 Existing on-site groundwater and Petaluma River water near the points of discharge from the site are
45 generally brackish to saline and are not utilized as a source of drinking water. No impacts on drinking
46 water supplies are expected.
47

MITIGATION MEASURES

Mitigation measures will not be required since no significant impacts are anticipated.

4.2.7.5 Sonoma Baylands

At the Sonoma Baylands Site, no significant impacts are expected on surface and groundwater quality.

To evaluate the potential for contaminants to migrate from dredged sediments into effluent, leachate, and surface runoff, tests were performed on two composited sediment samples, one from Outer Harbor sediments and one from Inner Harbor sediments (Lee et al. 1992, 1993). Results of these tests are discussed below and presented in Tables 4.2.7.5-1 and 4.2.7.5-2. Because dredged sediments to be used at the Sonoma Baylands site will meet both the RWQCB sediment screening criteria for wetlands creation and ocean disposal criteria, sediments with the highest concentrations of contaminants will not be used at Sonoma Baylands. Because the composite samples from Oakland Inner and Outer Harbor used for effluent, leachate, and surface runoff tests include sediment with higher concentrations of contaminants than will be used at Sonoma Baylands, potential water quality impacts should be lower than those discussed below.

Impacts on Groundwater

Because low permeability bay muds underlie the site, the potential for infiltration of leachate and pore water from the dredged material to groundwater is considered minimal. Although local lateral flow gradients may be affected at the site due to an increase in the hydraulic head, groundwater is expected to move toward San Pablo Bay in the direction of regional groundwater flow, which is not considered a significant adverse impact. In addition, the underlying groundwater is not used for drinking water, potential impacts on groundwater supplies are not considered significant.

Sediment quality data from sediments proposed for use in wetlands restoration at Sonoma Baylands were compared to the 1992 RWQCB Sediment Screening Criteria for wetlands creation and other beneficial uses (see Table 4.2.7.5-3). The RWQCB uses sediment screening criteria to evaluate the acceptability of dredged sediments for beneficial uses such as wetland creation for both cover and non-cover (greater than 3 feet) disposal purposes. The RWQCB will evaluate the acceptability of all sediments to be used to restore tidal wetlands at the site. The LTMS program is currently developing improved guidance on screening sediments for wetland creation. Until this guidance is developed, the RWQCB interim sediment screening criteria (SSC) can be used to indicate a concern and the need for further evaluation of sediments that exceeded the criteria values. However, on the basis of this comparison, sediment core locations have been selected for use at the Sonoma Baylands Restoration Site based on their acceptability for wetlands non-cover and cover, levee restoration, or landfill daily cover usage (see Table 4.2.7.5-3).

The sediment screening criterion for chromium, which is frequently exceeded, was not used in this evaluation because of the following considerations. Chromium is a common metal in San Francisco Bay soil and sediments derived from local serpentinite bedrock. Much of the chromium in Port of Oakland sediments is believed to be native because generally similar concentrations are found throughout the Inner and Outer Harbor both laterally and vertically, regardless of proximity to potential anthropogenic source areas such as the proposed Inner Harbor Turning Basin. For example, undisturbed Merritt Sand samples (OB1, IB2, CH4, MS-1, MS-2, OI-CH-1, OI-CH-4A, OI-CH-6A, and OO-W-5; Battelle 1990, 1992)

Table 4.2.7.5-1. Comparison of Test-Specific Acceptance Limits to Leachate Test Results
Sonoma Baylands
 (page 1 of 2)

<i>Parameter</i>	<i>Lowest Freshwater or Marine Objective¹</i>	<i>Kinetic/ Sequential Leachate Acceptance Limit^{**}</i>	<i>Kinetic/ Sequential Leachate Highest Mean Value²</i>	<i>Rainwater Extraction Acceptance Limit^{***}</i>	<i>Rainwater Extraction Highest Mean Value³</i>	<i>Pore Water Acceptance Limit^{****}</i>	<i>Pore Water Highest Mean Value³</i>
Metals (µg/l)							
Arsenic	36	1,800	72.1	720	9	7,200	43.5
Cadmium	0.66	33	1.7	13.2	2	132	1.3
Chromium (total)	210	10,500	64.8	4,200	<10	42,000	3.7
Copper	2.9	145	102.5	58	4	580	46
Lead	1.3	6.5	43.2	2.6	8	260	50
Mercury	.012	0.6	0.09	0.24	<0.2	2.4	0.14
Nickel	8.3	415	54.6	166	16	1,660	20
Zinc	59	2,950	104.2	1,180	8	17,200	49
Iron	1,000	50,000	--	20,000	16,200	11,800	208
Manganese	--	2,500	--	1,000	1,180	10,000	1,643
Selenium	5.0	250	--	100	--	1,000	--
Silver	2.3	115	--	46	--	460	--
Inorganics (mg/l)							
TDS	--	125	--	50	1,384	500	--
Chloride	--	62.5	--	25	759	250	9,633
Sulfate	--	62.5	--	25	35	250	737

Table 4.2.7.5-1. Comparison of Test-Specific Acceptance Limits to Leachate Test Results
Sonoma Baylands
 (page 2 of 2)

<i>Parameter</i>	<i>Lowest Freshwater or Marine Objective¹</i>	<i>Kinetic/ Sequential Leachate Acceptance Limit^{**}</i>	<i>Kinetic/ Sequential Leachate Highest Mean Value²</i>	<i>Rainwater Extraction Acceptance Limit^{***}</i>	<i>Rainwater Extraction Highest Mean Value³</i>	<i>Pore Water Acceptance Limit^{****}</i>	<i>Pore Water Highest Mean Value³</i>
Organics (µg/l)							
PCBs	--	0.00175	--	0.00078	--	0.007	--
DDT	--	0.015	--	0.006	--	0.06	--
PAHs	0.031	0.775	0.1938	0.155	--	3.1	--
TBT	.005	0.125	0.1687	0.05	0.0901	0.5	0.173

Notes: * AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 10 for WET and 20 for TCLP

** AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 4

*** = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 10

**** AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 1

WQO = Lowest freshwater or marine objective

AF = Attenuation factor

DF = Dilution factor

AL = Acceptance limit

1 = See Tables 3.2.1-1 and 3.2.1-2

2 = See Tables K-7 and K-8

3 = See Table K-9

Values in bold exceed the acceptance limit

Source: Lee et al. 1992 and 1993.

**Table 4.2.7.5-2. Modified Elutriate and Surface Runoff Test-Specific Dilution Factors Necessary to Meet Water Quality Objectives
Sonoma Baylands**

<i>Parameter</i>	<i>Lowest Basin Plan Marine Objective</i>	<i>ELUTRIATE HIGHEST MEAN VALUE</i>		<i>Dilution Factor to Meet Water Quality Objective +</i>	<i>Surface Runoff (Filtered) Highest Mean Value</i>	<i>Dilution Factor to Meet Water Quality Objective</i>
		<i>Dissolved</i>	<i>Total</i>			
Metals (µg/l)						
Arsenic	36	3.97	4.958	/a/	8.58	/a/
Cadmium	9.3	0.2867	0.095	/a/	0.444	/a/
Chromium (total)	---	3.688	3.993	---	1.89	---
Copper	2.9	33.6	2.34	11.5	5.99	2.0
Lead	5.6	17.317	19.9	3.1	0.891	/a/
Mercury	2.1	0.0407	0.008	/a/	0.047	/a/
Nickel	8.3	4.66	--	/a/	--	--
Zinc	86	45.9	12.08	/a/	33.9	/a/
Selenium	5.0	--	--	--	--	--
Silver	2.3	0.0267	--	/a/	1.08	/a/
Organics (µg/l)						
PAHs	15	0.0468	/a/	/a/	--	--
TBT	0.04	0.24	0.0256	6	0.096	2.4

Note: a. Below lowest marine basin plan shallow marine water effluent limitations without dilution.

+ Largest dilution factor required to meet water quality objective for either dissolved or total measurement.

Source: Lee et al., 1992 and 1993; see also Tables K-4 and K-5.

Table 4.2.7.5-3. Comparison of Oakland Inner Harbor and Outer Harbor Sediment Quality Data to RWQCB Sediment Screening Criteria

Parameter (mg/kg)	RWQCB SSC Wetlands Creation Noncover	RWQCB SSC Wetlands Cover/Levee Restoration/ Landfill Daily Cover	LEE ET AL. 1991, MEAN CONCENTRATION + +		
			Oakland Inner (44 ft)	Oakland Outer (44 ft)	Oakland Inner (39 ft)
Cadmium	9 - 5	<5	0.148	0.233	0.22
Chromium	300 - 220	<220	381.3 ab	364 ab	256 b
Copper	390 - 90	<90	24.53	31.07	28.6
Lead	110 - 50	<50	14.15	18.67	13.2
Mercury	1.3 - 0.35	<0.35	0.11	0.166	0.164
Nickel	200 - 140	<140	65.2	84.03	72.7
Silver	2.2 - 1.0	<1.0	0.11	0.203	0.194
Selenium	1.4 - 0.7	<0.7	0.173	0.267	0.17
Zinc	270 - 160	<160	61.1	84.8	77.8
Arsenic	85 - 33	<33	5.62	6.9	9.9
PCBs	0.4 - 0.05	<0.05	<0.031	<0.031	na
tDDT	0.1 - 0.003	<0.003	<0.003	<0.003	<0.003
tPAHs	35 - 4	<4	0.807	0.7257	3.991

Notes:

- a. Exceeds wetlands creation noncover SSC.
- b. Exceeds wetlands cover/levee restoration/landfill daily cover SSC.
- mg/kg milligrams per kilogram
- na Not analyzed
- PCBs Polychlorinated biphenyls
- RWQCB California Regional Water Quality Control Board
- SSC Sediment screening criteria
- tDDT Sum of 4,4'-DDT; 4,4'-DDD; and 4,4'-DDE
- tPAHs Sum of polycyclic aromatic hydrocarbons
- () Number of samples exceeding wetlands cover/levee restoration/landfill daily cover SSC
- + Mercury data reanalyzed due to lab contamination. Corrected values from Battelle, 1993.
- + + Mean values as reported in referenced report; not weighted for volume of dredged material characterized by each sample.
- * Sample numbers: IC-8, IC-9, IC-10, IC-11, IC-12, IC-14
- ** Sample numbers: IS-1, IT-3, IT-5
- *** Sample numbers: IC-2, IC-8, IC-8 top 6" (highest replicate value)
- **** Sample numbers: OC-1, OC-2, OC-4, OC-9, OC-11, OC-12, OC-13
- # Sample numbers: IB-1, IB-2, IB-3
- ## Sample numbers: OB-1, OB-2, OB-3 (highest replicate value)

Values in bold exceed noted criteria

1 have chromium values ranging from 164 to 823 mg/kg. These high values likely reflect the deposition
2 of native locally derived sand-sized serpentinite rock fragments. Serpentinite rocks generally contain
3 chromium concentrations of about 2,400 ppm (Goles 1967). In fact, Long and others (1988) state in their
4 review of contaminants in San Francisco Bay "that a major portion of chromium in the sediments of the
5 San Francisco Bay area may be of geologic origin."
6

7 However, Oakland Harbor samples do tend to be higher in chromium than bay mud samples from four
8 existing tidal marshes bordering San Pablo Bay. Chromium concentrations ranged from 174 to 219
9 mg/kg (Lee et al. 1991), which are generally lower than concentrations in samples from the Oakland
10 Inner and Outer Harbor. This finding is expected since most high values from Port sediments are from
11 undisturbed native Merritt Sands, not bay muds. Chromium in serpentinite-derived sediments is likely
12 to be bound within mineral grains and is not bioavailable. Bioaccumulation test results show that at least
13 some of the chromium in the 42-foot sediments is bioavailable. However, the Battelle Phase I and II
14 reports contain bioaccumulation test results using *Macoma* for pure Merritt sand and indicate that the
15 chromium in the sands does not bioaccumulate to magnitudes that can be distinguished from genetic
16 variability of bioaccumulation observed in wild-caught test organisms.
17

18 The oxidation state of chromium largely determines toxicity for saltwater organisms. Chromium in rock
19 and sediments is typically in water in the chromium III oxidation state, the least toxic and soluble form.
20 The acute toxicity of chromium III to saltwater organisms ranges from 10,300 to 31,500 ppm (Long and
21 Morgan 1990). Saltwater organisms exposed to soluble chromium via contact with Port of Oakland
22 dredged sediments are not likely to experience toxic effects from the chromium. This is because soluble
23 chromium is expected to be very low; Waste Extraction Test results indicate at most 9.5 ppm of soluble
24 chromium (see section 4.2.7.6). This conclusion is also supported by recent work by Anderson et al.
25 (1993) who found, in a review of San Francisco Bay sediment and toxicity data, no correlation between
26 total chromium content and sediment toxicity to amphipods. The limited soluble chromium VI data
27 available for samples from the Inner and Outer Harbor and Turning Basin Wings indicate very low levels,
28 ranging from <10 to 30 ppb (Eureka Laboratory 1993; Battelle 1993; COE and Battelle 1993,
29 unpublished data; WCC 1988; HLA 1989; Battelle 1993). The acute saltwater toxicity of chromium VI
30 ranges from 2,000 to 105,000 ppb; no toxic effects are expected at the concentration of chromium VI
31 found in Port sediments.
32

33 The RWQCB set sediment screening criteria using toxicity and sediment chemistry relationships
34 established by Long and Morgan (1990) from numerous sites throughout the United States. Although the
35 RWQCB partially adjusted the chromium sediment screening criteria to take into account San Francisco
36 Bay conditions, the final criterion choice was based on preliminary apparent effects threshold data for two
37 species, bivalve larvae and amphipod. On the basis of the considerations stated above, further work
38 appears to be needed to develop an accurate sediment screening criteria for chromium that takes into
39 account the native geological and biological condition of San Francisco Bay. Because the sediment
40 screening criteria appear to be inappropriate for naturally occurring chromium in Bay sediments,
41 chromium sediment screening criteria were not used in evaluating sediment acceptability. The RWQCB
42 has recently stated that the chromium criterion may be too restrictive for wetland restoration, and that
43 they plan to address the specific material acceptance criteria for Sonoma Baylands through the permit
44 process (personal communication, T. Gandesbery 1994).
45
46

Impacts on Surface Water

The Sonoma Baylands site will be filled by levee/peninsula materials regraded from the site and dredged material from the Port of Oakland. The perimeter levee along the south will remain, and an additional levee will be constructed along the rest of the site perimeter at a distance of 100 feet from the existing drainage ditches surrounding the site. Interior on-site drainage will be altered by levee/peninsula construction, placement of dredged material, and restoration of the site to a tidal marsh.

The existing interior drainage features, comprising a series of ditches that drain toward perimeter levees surrounding the site, will initially be altered by site regrading and the construction of perimeter levees to contain the dredged material. After construction of the perimeter levees and the placement of dredged material, on-site discharges will be controlled by site operations. Releases of decanted water from the dredged slurry placed on site will be controlled by spillways at three locations in the existing outer levee. Discharges through the spillways will be monitored to ensure that sufficient retention time occurs for fine-grained particulates to settle out. Discharges during construction will be controlled until the water meets state water quality standards.

Using stockpiled topsoil from the existing hay fields on the levees and peninsulas above the marsh plain fill will hasten the reestablishment of vegetation, thereby minimizing erosion and sedimentation during construction. Adherence to NPDES erosion and sedimentation controls and BMPs during site construction, in combination with the containment berms and revegetation incorporated into the site design, will eliminate potentially significant impacts of increased sedimentation into adjacent surface waters.

After the perimeter levee is breached and full tidal circulation is restored across the site, some of the dredged material will be remobilized. Tidal flows and velocities at the perimeter levee breach locations will increase localized erosion in the existing tidal slough channels and the bordering marsh (COE 1993). Remobilization of the dredged material by tidal currents and wind-generated waves across the open fetch of the southern portion of the site will increase local turbidity and sedimentation until the eroded material is redeposited. No significant off-site transport is expected. The impacts of increased turbidity and sedimentation will be short term and eliminated eventually when equilibrium is established in the restored tidal marsh and tidal sloughs. These localized short-term impacts are considered to be insignificant because high turbidity is characteristic of the water in dynamic tidal marsh environments, including the adjacent mudflats south of the project that have high levels of wave-generated turbidity. Because only sediments that pass the sediment screening criteria and are also acceptable for ocean disposal will be accepted, erosion and redeposition of Port sediments is not considered a significant impact on local surface water quality. No significant sedimentation impacts on adjacent surface water are anticipated.

The results of the modified elutriate tests for composites of Inner and Outer Harbor sediments (see Table 4.2.7.5-2) indicate that, relative to RWQCB marine surface water quality objectives, potentially significant water quality impacts for copper, lead, and tributyltin could be expected if particulates entrained in the elutriate are released, not adjusting for dilution by receiving waters. The long retention time in the control basin will allow sufficient time for microbial and chemical degradation of any tributyltin present in the surface runoff. Tributyltin has been shown to degrade in estuarine waters in three to 13 days (Lee et al. 1989). Project design should provide for adequate dilution to reduce the levels of copper and lead below state standards.

Because makeup water from San Pablo Bay will provide most of the effluent (80 to 85 percent of the incoming slurry), the expected salt concentration in the effluent will be similar to the nearby discharge point in San Pablo Bay, even with salt contributions from the dredged sediments. No significant impact is expected.

The existing site lies within a FEMA Zone VI flood hazard designation area and is potentially subject to coastal flooding, high tides, and overbank flooding from the Petaluma River. The enlargement of the existing perimeter levees to the east and west, and construction of a new levee along the northern site perimeter will not increase the flooding potential of adjacent properties.

The use of dredged sediments will accelerate the restoration of intertidal marsh at the Sonoma Baylands site. The dredged sediments will be buried by a considerably larger volume of sediment from natural sedimentation once the outboard levee is breached. Because only sediments suitable for wetland creation will be deposited at Sonoma Baylands, no significant direct impacts on surface water are expected upon saltwater marsh creation. Sediments were determined to be suitable for wetland creation by being suitable for ocean disposal based on Green Book testing, and secondly by meeting the RWQCB's sediment quality screening criteria. Consequently, the concentration of contaminants present in the sediments ultimately determined suitable for wetland creation are low, similar or less than that measured in typical bay wetland sediments. Therefore, the sediments deposited at Sonoma Baylands should not pose any significant direct impacts on surface water.

Impacts on Drinking Water Supplies

Because of the proximity of the site to San Pablo Bay, surface water and shallow groundwater is expected to be brackish and not a potential source of drinking water as defined by SWRCB guidelines. This is confirmed by the presence of brackish water in on-site and nearby wells. The nearest existing domestic supply wells are upgradient (i.e., "upstream" of the direction of groundwater flow) of the site. If these wells are screened in shallow, fresh groundwater, and therefore are taking water from this zone, and if heavy pumping from the one or more wells occurs for an extended period, the disposal of dredged sediments, as well as conversion to intertidal wetland, may impact these local potential drinking water supplies. However, the low permeability bay mud underlying the site would limit infiltration to deeper and potentially fresher groundwater aquifers and rapidly attenuate the concentration of any constituents that may be released. If the domestic wells are screened in a deeper aquifer, sediment disposal and intertidal wetlands creation are unlikely to impact these local potential drinking water supplies.

Mitigation Measures

For wetland creation, significant impacts on surface and groundwater water quality are not expected because only sediments meeting both the sediment screening criteria (SSC) (excluding chromium) and ocean disposal criteria will be accepted and because of the natural attenuation capacity of the underlying bay mud. Because the site will be converted to tidal wetlands, no mitigation is needed for potential salt impacts. Limiting particulate releases in the effluent in accordance with the RWQCB requirements for construction on Sonoma Baylands will prevent significant releases of particulates in effluent and also the constituents bound to such particulates. Effluent will meet RWQCB standards and any applicable conditions of RWQCB authorization including any mandated dilution or treatment of discharged water.

4.2.7.6 Galbraith Golf Course

With appropriate management and facility design, the Galbraith Golf Course option would result in significant impacts on surface and groundwater; however, these impacts could be mitigated to insignificance.

Impacts on Groundwater

The primary potential impacts of dredged sediment disposal on groundwater include the vertical migration of slurry makeup water/pore water and the induced lateral migration of existing landfill leachate due to loading by the dredged sediment materials. The following sections summarize these potential impacts and discuss their importance. Following the summary, additional detail is provided discussing the quality of the sediments proposed for Galbraith and potential impacts on groundwater.

During disposal at the Galbraith Golf Course, a temporary increase in the local hydraulic head will result; consequently there is the potential for vertical infiltration and migration of slurry makeup water and pore water from the dredged sediments into groundwater. In addition, rainwater infiltrating through the sediments could also leach soluble constituents into groundwater. Dissolved constituents in the pore water and slurry makeup water and constituents leached from the dredged sediments by rainwater could impact groundwater quality beneath the disposal site. However, this is unlikely because (1) low permeability bay muds and fine-grained alluvium underlie the site, (2) significant leaching of silty/clayey, generally low permeability, dredged sediments by rainwater is not expected, and (3) the existing shallow groundwater is already brackish or saline over most of the site. Thus, the potential for infiltration of significant amounts of leachate and pore water and corresponding impacts on water quality is considered minimal. Although shallow groundwater in the eastern portion of the site appears to be relatively fresh (i.e., TDS values below 3,000 mg/l), the potential impact of saline pore water and slurry makeup water that may occur on groundwater on this area is not considered significant because this shallow groundwater is not used for drinking water purposes (TDS values currently exceed MCLs).

There are no known wells in the vicinity of the golf course (i.e., within a 1/2-mile radius) are used for drinking water purposes because drinking water for the area is imported by East Bay MUD (personal communication, A. Godfrey 1994). He also stated that shallow groundwater (i.e., less than 100 feet deep) in the area is generally brackish or saline and that large producing wells in the area, which are generally used for industrial and irrigation purposes, pump water from depths of between 200 and 500 feet below ground surface.

Prior to disposal of dredged sediments, groundwater gradients at the site are expected to vary locally due to tidal influence and the direction of regional groundwater flow toward San Francisco Bay. Short-term increases in hydraulic head during disposal could cause limited transient increases in local groundwater velocity that would diminish as the slurry water decants and evaporates and as bay mud and the alluvium consolidate and reach equilibrium. Conceptual design calculations performed by Subsurface Consultants indicate a rapid decline (i.e., over a period of months) in hydraulic heads following decanting operations (Subsurface Consultants, unpublished data). Following disposal, any impacted groundwater could migrate toward the drainage channel and San Francisco Bay if the gradient were sufficient.

Hydraulic head increases to and water quality impacts on groundwater on the eastern side of the site are expected to be long term but of limited lateral extent. Head differences (driving forces) are expected to

be generated at the initiation of disposal and to taper off as the effluent water decants and the sediment dries out (i.e., 4 to 5 years). Regional flow directions are likely to sweep any impacted water locally introduced at the site toward the bay. Following dissipation of the local groundwater mound, no variation in regional flow direction or gradient is expected.

In this disposal scenario, dredged sediments would be hydraulically placed directly on top of or near existing landfill materials. Existing brackish to saline groundwater in contact with the landfill materials in the western two-thirds of the site would likely be similar in composition to slurry water and/or leachate that could migrate from the sediments into the underlying landfill materials. Therefore, although additional volumes of leachate could be generated by movement of fluids from the disposal area through the landfill material, mobilization of additional dissolved constituents from the landfill would not be expected because the saline leaching fluid is expected to be similar in composition to the existing saline leachate derived from bay water infiltration. On the eastern side, fresher water may come in contact with landfill materials. Additional dissolution of constituents by the saline pore water may be possible. However, in areas where existing landfill contamination has been observed (i.e., the petroleum hydrocarbons found in shallow leachate along the southern boundary of the site), water from wells screened in underlying bay mud and alluvial materials does not contain contamination levels similar to those in the overlying landfill leachate. This suggests that, even though fill materials have been subjected to rainwater/irrigation infiltration for over 20 years since the landfill closed, bay mud materials have acted as an effective vertical barrier to migration of petroleum hydrocarbons. This may also indicate that the contaminants are only sparsely soluble in groundwater. Hence, the generally low permeability, fine-grained dredged materials, which have similar properties and origin to the underlying fine-grained materials, are likely to act as a cap preventing (1) significant infiltration of fluids through the petroleum hydrocarbon contaminated fill materials and (2) continued vertical leaching. The possible impact of vertical migration of fluids is not considered significant.

Although vertical migration of fluids is not considered significant, lateral migration of pore water/slurry water through underlying, potentially higher permeability landfill materials, may be significant. Also, loading of dredged materials on underlying landfill and native materials may induce lateral migration of landfill fluids as pore space is compressed. This is especially true in areas of the landfill where existing petroleum hydrocarbon-containing leachate may be squeezed out of fill materials. Lateral migration of pore water/slurry water and/or landfill leachate is considered a significant potential impact; this impact is considered to be of limited lateral extent.

Consequently, the RWQCB has required that the Galbraith facility include a subsurface cutoff wall to attenuate the lateral migration of fluids contained in the landfill. The clay wall will be about two feet thick and will extend down into the bay mud layer underneath the former landfill and up into the dikes that surround the drying ponds. The cutoff wall will significantly slow down the lateral migration of landfill liquids and will thereby reduce contaminants leaving the facility to levels below water quality standards. The design of the cutoff wall will follow the landfill design standards prescribed in Article 23, Chapter 15, of the California Code of Regulations. A groundwater monitoring system will be installed outside the cutoff wall to confirm that it is effective and that the project is not causing groundwater outside the landfill to exceed water quality standards.

The quality of dredged material proposed for disposal at Galbraith and potential impacts on surface and groundwater quality were further reviewed in five ways: (1) comparison of sediment and WET data to Title 22 hazardous waste criteria, (2) comparison to RWQCB SSC for landfill daily cover, (3) a

qualitative discussion of subsurface attenuation factors at the site, (4) comparison of leachate test data to existing groundwater quality data, and (5) comparison of sediment chemistry data of proposed dredged materials to existing sediment quality. The WES leachate test data may be more appropriate to use in the evaluation of potential leachability of contaminants from dredged material. However, the state methodology requires evaluation of the potential impacts on groundwater by comparing sediment quality data to hazardous waste criteria and sediment screening criteria. If criteria are significantly exceeded, this may indicate that a sufficient mass of a constituent may be present in the soil material to potentially leach out under acid landfill conditions to potentially impact groundwater quality. Since the dredged materials make-up water will infiltrate the landfill, this analysis will use both WES leachate test and WET data to assess the potential groundwater impacts.

First, Title 22 specifies that a material is classified as hazardous waste if bulk (total) chemistry values exceed total threshold limit concentrations (TTLCs) or if leachate data obtained from WET exceed soluble threshold limit concentrations (STLCs). Table 4.2.7.6-1 presents a summary of bulk and WET data for 18 samples collected from areas slated for disposal at Galbraith and associated TTLCs and STLCs. As discussed in HLA (1994), none of these bulk chemistry or WET sample concentrations exceeded TTLCs or STLCs, nor do any of the bulk chemistry values from the entire data set (Table 4.2.7.6-1) exceed TTLCs.

For samples slated for Galbraith that were not subjected to the WET, Table 4.2.7.6-1 also provides a column showing an order of magnitude (10x) increase above the STLCs. Conceptually, if a bulk test value exceeds 10 times the respective STLC (10 is the amount of dilution in the WET protocol), it is possible to generate a leachate that would exceed the STLCs. For all of the bulk chemistry tests, the maximum values observed do not exceed 10 times the respective STLCs, with a few minor exceptions (copper, lead, mercury, and nickel).

For the exceptions identified for the entire Galbraith data set (copper, lead, mercury, and nickel), expected WET results can be predicted if the assumption is made that there is a general correlation between high bulk chemistry results and high WET results. The maximum values in the entire Galbraith data set are factors of 1.0, 1.4, 5.2, and 1.2 greater than the maximum bulk chemistry values of copper, lead, mercury, and nickel, respectively, in the Galbraith WET sample data set. If WET were conducted on the rest of the Galbraith samples and assuming these factors would apply to WET results as well, then, using the maximum observed WET results and applying these factors, predicted WET values for copper, lead, mercury, and nickel would be 0.2, 1.7, 0.05, and 4.3 mg/l, respectively. All of these values are well below their corresponding STLCs.

This suggests that if sediment samples having high copper, lead, mercury, and nickel concentrations were subjected to the WET, results would not exceed STLCs. These comparisons indicate that even if all Port sediments were subjected to the WET, it would be physically impossible for the WET to generate a leachate that would exceed STLCs. In other words, Inner, Outer, and Turning Basin sediments slated for disposal at Galbraith are not hazardous waste.

Second, for screening purposes, bulk chemistry data were compared to RWQCB SSC for landfill daily cover (RWQCB 1992b). The rationale for making this comparison is that if the dredged materials pass these criteria they would be suitable for use as cover material for the former Galbraith Landfill if it were still in operation. In other words, if the material is clean enough to be used as daily cover, it should be

**Table 4.2.7.6-1. Comparison of WET and Bulk Chemistry Results to
STLC and TTLC Criteria
Galbraith Golf Course Disposal Alternative
(page 1 of 2)**

<i>Parameter</i>	<i>Galbraith WET Results Inner/Outer Harbor Turning Basin (mg/l)*</i>	<i>STLC Criteria (mg/l)</i>	<i>10x STLC (mg/l)</i>	<i>Galbraith WET Data Set Inner/Outer Harbor Turning Basin Maximum Value (mg/kg)</i>	<i>GALBRAITH ENTIRE DATA SET</i>		
					<i>Bulk Chemistry Maximum Value Dry Weight (mg/kg)</i>	<i>Bulk Chemistry Mean Value Dry Weight (mg/kg)</i>	<i>TTLC Criteria (mg/kg)</i>
Antimony	<0.1-<0.5(0.12)	15	150	NC	18.83	4.53	500
Arsenic	0.026-0.16(0.04)	5	50	NC	28.91	8.71	500
Barium	0.2-3.9(0.99)	100	1,000	NC	104	66.92	10,000
Beryllium	<0.005-<0.05(0.021)	0.75	7.5	NC	0.65	0.38	75
Cadmium	0.006-<0.05(0.02)	1	10	NC	8.04	0.77	100
Hexavalent Chromium	<0.01-<0.27(0.01)	5	50	NC	--	--	500
Chromium	0.1-9.5(1.3)	560	5,650	NC	930	359.99	2,500
Cobalt	0.053-<0.21(0.12)	80	800	NC	13.73	10.14	8,000
Copper	0.007-0.2(0.08)	25	250	423	423	70.09	2,500
Lead	<0.1-1.2(0.43)	5	50	180	246	48.92	1,000
Mercury	<0.001-<0.01(0.004)	0.2	2	1.6	8.3	0.65	20
Molybdenum	<0.01-<0.1(0.04)	350	3,500	NC	1.02	3.5	3,500
Nickel	0.14-3.6(0.63)	20	200	180	212	91.76	2,000
Selenium	<0.0005-<0.05(0.018)	1	10	NC	6.09	0.50	100
Silver	<0.003-<0.1(0.04)	5	50	NC	1.12	0.36	500
Thallium	<0.1-<0.5(0.1)	7	70	NC	0.65	1.06	700
Vanadium	0.1-1.4(0.66)	24	240	NC	66.1	55.12	2,400
Zinc	<0.1-9.7(2)	250	2,500	NC	549	144.90	5,000

**Table 4.2.7.6-1. Comparison of WET and Bulk Chemistry Results to
STLC and TTLC Criteria
Galbraith Golf Course Disposal Alternative
(page 2 of 2)**

<i>Parameter</i>	<i>Galbraith WET Results Inner/Outer Harbor Turning Basin (mg/l)*</i>	<i>STLC Criteria (mg/l)</i>	<i>10x STLC (mg/l)</i>	<i>Galbraith WET Data Set Inner/Outer Harbor Turning Basin Maximum Value (mg/kg)</i>	<i>GALBRAITH ENTIRE DATA SET</i>		
					<i>Bulk Chemistry Maximum Value Dry Weight (mg/kg)</i>	<i>Bulk Chemistry Mean Value Dry Weight (mg/kg)</i>	<i>TTLC Criteria (mg/kg)</i>
Aldrin**	--	0.14	1.4	ND	ND	ND	1.4
Chlordane	<0.005	0.25	2.5	ND	ND	ND	2.5
DDT, DDE, DDD	--	0.1	1	0.0022	0.02684	0.00297	1
2,4-D	--	10	100	--	--	--	100
Dieldrin	--	0.8	8	ND	0.01497	0.00164	8
Dioxin	--	0.001	0.01	--	--	--	0.01
Endrin	<0.005	0.02	0.2	ND	ND	ND	0.2
Heptachlor	<0.005	0.47	4.7	ND	0.00381	0.00102	4.7
Kepone	--	2.1	21	--	--	--	21
Organic Lead	<0.12	--	--	--	--	--	13
g-BHC (Lindane)	<0.0005	0.4	4	ND	0.00054	0.00105	4
Methoxychlor	<0.001	10	100	ND	ND	ND	100
Mirex	--	2.1	21	--	--	--	21
Pentachlorophenol	<0.01	1.7	17	ND	ND	ND	17
PCBs	--	5	50	0.032	0.7452	0.08835	50
Toxaphene	<0.01	0.5	5	ND	ND	ND	5
Trichloroethylene	<0.005	204	2,040	ND	ND	ND	2,040
2,4,5-TP	--	1	10	--	--	--	10

Notes: NC Not calculated
 * Maximum values listed for organics due to infrequent detections
 ** Minimum-maximum (mean); mean calculated using 1/2 the detection limit for non-detect values
 Values in bold exceed 10x the STLC criteria
 Test data from HLA 1994 compilation; WET results from Battelle 1993b, c; HLA 1989; Corp 1993; and WCC 1988.

**Table 4.2.7.6-2. Comparison of Sediment Quality Data to
Sediment Screening Criteria
Galbraith Golf Course Disposal Alternative**

<i>Parameter</i>	<i>Maximum (mg/kg)</i>	<i>Arithmetic Mean (mg/kg)</i>	<i>Sediment Screening Criteria Landfill Daily Cover (mg/kg)</i>
Cadmium	8.04	0.77	< 5
Chromium	930	359.99	< 220
Copper	423	70.09	< 90
Lead	246	48.92	< 50
Mercury	8.3	0.65	< 0.35
Nickel	212	91.76	< 140
Silver	1.12	0.36	< 1.0
Selenium	6.09	0.50	< 0.7
Zinc	549	144.9	< 160
Arsenic	28.91	8.71	< 33
PCBs*	0.7452	0.08835	< 0.05
Total DDT*	0.02684	0.00297	< 0.003
Total PAH*	5.331	0.604	< 4

Note: * Maximum value for individual PCB, DDT (or metabolite), or PAH from Table 3 of HLA 1994; see also Table K-3.

suitable for disposal at Galbraith. Table 4.2.7.6-2 compares bulk chemistry data to daily cover SSC. As indicated in Table 4.2.7.6-2, the mean concentrations of most constituents do not exceed the SSC for landfill daily cover (cadmium, copper, lead, nickel, silver, selenium, zinc, arsenic, PAH and DDT); the exceptions are chromium, mercury, and PCBs. For mercury and PCBs, mean values only slightly exceed the SSC. High chromium concentrations in Port sediments are most likely naturally occurring, and SSC do not reflect the high native chromium contents of Bay Area sediments. This suggests that a large proportion of the dredged sediment would pass most of the SSC and would be considered acceptable for landfill daily cover on the basis of bulk chemistry values alone.

Third, the capacity of the underlying bay mud and fine-grained alluvial materials to attenuate chemical concentrations in the subsurface was evaluated. Fine-grained sediments are capable of adsorbing constituents on organic and clay particles. In the process of adsorption, the relative concentration of a constituent is reduced, i.e., attenuated. The analysis that follows is based on protocols developed by the RWQCB for estimating subsurface attenuation factors at Class III landfills (HLA 1994).

The RWQCB has developed five basic criteria for determining attenuation factors for Class III landfills in Region 2. Attenuation factors are established for the manner in which each criterion is satisfied by site conditions. The criteria are groundwater separation, native materials, liners, leachate recovery/collection system (LR/CS), and location (RWQCB 1992a). Based on water-level measurements from 15 wells, depth to groundwater at Galbraith ranges from about 2.5 to 15.5 feet below ground surface (bgs). Most groundwater is found within 10 feet of ground surface (section 3.2.4.6). Underlying native (non-fill) materials consist largely of bay mud and fine-grained (clay and silt) alluvial materials below the bay mud; the combined thickness of these materials ranges between 5.5 and 20 feet. The first substantial sand unit (5.5 feet thick) was encountered at 29.5 feet bgs beneath 9.5 feet of fill and 20 feet of bay mud and alluvial clays. In addition, the dredged material to be disposed at Galbraith contains substantial amounts of fine-grained materials, with silt and clay percentages ranging from 2 to 62 percent and 2 to 67 percent, respectively. The proposed disposal area is bisected by a drainage channel that is partially influenced by tidal fluctuations. San Francisco Bay is less than a quarter mile from the southwestern boundary of the site. No LR/CS or liners are present at Galbraith.

These site characteristics indicate that the only criterion that leads to an attenuation factor at Galbraith is the presence of fine-grained materials, including both existing subsurface materials and the proposed dredged sediments themselves. Attenuation factors of 200 for inorganics and 100 for organics could be specified for Galbraith, following the RWQCB methodology. No attenuation factors are appropriate for dissolved inorganic parameters such as TDS, chloride, and sulfate because these constituents are not adsorbed by subsurface materials.

As a check on the adequacy of these in situ attenuation factors to reduce potential leachate concentrations to levels that would meet groundwater and surface water quality objectives, material acceptance criteria were developed for a limited set of constituents commonly found in 42-Foot Project sediments that have generally the lowest water quality objectives (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, selenium, zinc, iron, manganese, TDS, chloride, sulfate, PCBs, DDT, PAHs, and TBT). Material acceptance limits followed calculations specified by the RWQCB (1992a):

**Table 4.2.7.6-3. Appropriate Water Quality Limits and Objectives
Galbraith Golf Course Disposal Alternative**

<i>Parameter</i>	<i>Units</i>	<i>Federal MCL ¹</i>	<i>State MCL ¹</i>	RWQCB BASIN PLAN MARINE SURFACE WATERS WATER QUALITY OBJECTIVE ²	
				<i>Aquatic Life</i>	<i>Human Health</i>
Arsenic	µg/l	50	50	36	--
Cadmium	µg/l	5	10	9.3	--
Chromium	µg/l	100	50	--	--
Copper	µg/l	1,000	--	2.9	--
Lead	µg/l	15	50	5.6	--
Mercury	µg/l	2	2	2.1	0.025
Nickel	µg/l	100	--	8.3	4,600
Silver	µg/l	100	50	2.3	--
Selenium	µg/l	50	10	5	--
Zinc	µg/l	5,000	--	86	--
Iron	µg/l	300	--	--	--
Manganese	µg/l	50	--	--	--
TDS	mg/l	500	--	--	--
Chloride	mg/l	250	--	--	--
Sulfate	mg/l	250	--	--	--
PCBs	µg/l	0.5	--	0.03	0.00007
DDT	µg/l	--	--	0.001	0.0006
PAHs	µg/l	0.2	--	--	0.031
TBT	µg/l	--	--	--	0.005

Note: -- No criteria established.

1. EPA 1993. Drinking Water Standards and Health Advisors Table. Region IX Drinking Water and Groundwater Protection Branch.
2. RWQCB 1992. Water Quality Control Plan, San Francisco Bay Region (2), Table III-2A.

$$AL = (WQO \times AF)/DF$$

where:

AL = material acceptance limit

WQO = constituent water quality objective AF=attenuation factor

DF = dilution factor (test method specific)

A leachate test result exceeding a material acceptance limit calculated using the most restrictive water quality limit may indicate that in situ attenuation factors are not sufficient to protect water quality and that dilution in groundwater or surface water may be required to meet water quality objectives beyond the limits of the site.

The water quality objectives used are the California and federal maximum contaminant levels (MCLs) for drinking water and RWQCB Basin Plan objectives for marine surface waters. These are the most appropriate objectives for the protection of surface water and groundwater quality at Galbraith because of the presence of shallow fresh groundwater along the eastern boundary of the site and the surface water drainage channel that bisects the site and drains to nearby San Francisco Bay. Table 4.2.7.6-3 lists MCLs and objectives for the metals, organics, and inorganics previously listed.

The predictive tests completed on Inner and Outer Harbor and Turning Basin sediments that reflect potential leachate concentrations include the WET/TCLP, kinetic batch, sequential batch, rainwater extraction, and pore water tests (HLA 1994). For each of these tests, acceptance limits are calculated differently depending on dilution factors specific to each test method protocol. Dilution factors include 10 for the WET, 20 for the TCLP, 4 for the kinetic and sequential batch tests, 10 for the rainwater extract test, and 1 for pore water test (HLA 1993d).

Table 4.2.7.6-4 is a compilation of acceptance limits for each of these test types, as well as the highest average concentrations from each predictive test (HLA 1994). Values in bold indicate leachate test data that exceed an acceptance limit, indicating the potential for a water quality goal exceedance.

For the WET/TCLP tests, chromium, copper, lead, mercury, nickel, zinc, and TBT test results exceeded the material acceptance limits. However, as discussed by HLA (1993d, 1994), WET/TCLP tests do not reflect the likely leachate quality expected at Galbraith because the standard test protocol calls for use of a buffered acid leaching solution rather than the expected rainwater/irrigation water leaching fluid. In upland environments, the pH of dredged sediments may drop as natural sulfides in the sediments are oxidized during the drying process and acid is created. Past experience with Phase I Port sediment disposed and dried in upland environments (HLA 1991; Patrick 1990) has not shown substantial pH drops. Likewise, predictive tests (rainfall simulator/lysimeter and sequential batch tests) completed on 42-Foot Project sediments indicate sediment pH ranges from 6.88 to 8.29 in wet (anaerobic) sediments and 6.1 to 9.8 for dry (aerobic) sediments (section 4.2.2). At these sediment pHs, a relatively dilute, neutral leaching fluid would be expected.

Regardless of the character of leachate, if leachate is released into the subsurface and discharged to on-site surface water bodies, considerable dilution both within groundwater, site surface water, and at the point of discharge beyond the site boundaries is expected. A less-than-tenfold reduction in the WET/TCLP leachate is sufficient to meet the acceptance criteria for these parameters and, consequently, the water quality goal. Such a reduction is likely in the shallow subsurface and surface waters within the boundaries of Galbraith based upon the expected small volume of leachate relative to the much larger volume of groundwater and surface water at the site. As discussed previously, Subsurface Consultant's

**Table 4.2.7.6-4. Comparison of Leachate-Derived Acceptance Limits to Leachate Test Results
Galbraith Golf Course Disposal Alternative**

<i>Parameter</i>	<i>WET/TCLP Acceptance Limit*</i>	<i>WET/TCLP Highest Mean Value</i>	<i>Kinetic/ Sequential Leachate Acceptance Limit**</i>	<i>Kinetic/ Sequential Leachate Highest Mean Value</i>	<i>Rainwater Extraction Acceptance Limit#</i>	<i>Rainwater Extraction Highest Mean Value</i>	<i>Pore Water Acceptance Limit##</i>	<i>Pore Water Highest Mean Value</i>
Metals (ug/l)								
Arsenic	720	40	1,800	72.1	720	9	7,200	43.5
Cadmium	100	20	250	1.7	100	2	1,000	1.3
Chromium (total)	1,000	1,300	2,500	64.8	1,000	<10	10,000	3.7
Copper	58	80	145	102.5	58	4	580	46
Lead	112	430	280	43.2	112	8	1,120	50
Mercury	0.5	4	1.25	0.09	0.5	<0.2	5	0.14
Nickel	166	630	415	54.6	166	16	1,660	20
Silver	46	40	115	1.6	46	1.3	460	<0.3
Selenium	200	18	500	—	200	<0.3	2,000	—
Zinc	1,720	2,000	4,300	104.2	1,720	8	17,200	49
Iron	6,000	--	15,000	--	6,000	16,200	60,000	208
Manganese	1,000	--	2,500	--	1,000	1,180	10,000	1,643
Inorganics (mg/l)								
TDS	50	--	125	--	50	1,384	500	—
Chloride	25	--	62.5	--	25	759	250	9,633
Sulfate	25	--	62.5	--	25	35	250	737
Organics (ug/l)								
PCBs	0.00035	--	0.00175	--	0.00078	--	0.007	—
DDT	0.0003	--	0.015	--	0.006	--	0.06	—
PAHs	0.155	<10	0.775	0.1938	0.31	--	3.1	—
TBT	0.025	0.0299	0.125	0.1687	0.05	0.0901	0.5	0.173

Notes: Values in bold exceed the acceptance limit

AL = Acceptance limit

* AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 10 for WET and 20 for TCLP

** AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 4

AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 10

AL = (WQO x AF)/DF where AF = 200 for inorganics; 100 for organics; DF = 1

Source: Lee et al. 1992 and 1993.

conceptual design predicts only 2.5 feet of leachate infiltration due to low permeabilities and low lead differences. Thus, this potential impact is not considered significant. TBT results were also slightly above the material acceptance limits (which takes into account subsurface attenuation) developed for the kinetic/sequential leachate and rainwater extraction tests. This is not considered significant because only a slight dilution of any leachate that migrates from the dredged material into surface water and groundwater (within the boundaries of the site) would be required to meet the water quality objective for TBT at the site boundary. Additionally, TBT readily degrades in marine environments (Lee et al. 1989).

Finally, iron, manganese, TDS, chloride, and sulfate values from the rainwater extraction test and chloride and sulfate values from the pore water test exceeded their acceptance limits. Assuming no dilution in the underlying groundwater, this suggests that concentrations in pore water and leachate water are likely to exceed the corresponding MCLs for these compounds in shallow subsurface fresh groundwater on the eastern boundary of Galbraith.

Fourth, leaching and pore water test results were compared to background groundwater quality. Table 4.2.7.6-5 compares the highest mean concentrations of metals identified in leaching and pore water tests (from Table 4.2.7.6-4) to background groundwater quality at the Galbraith Golf Course. Assuming that the leaching tests results represent the worst case concentrations of metals in leachate derived from the sediment, the comparison can be used to evaluate potential worst case impacts on groundwater. With the exception of cadmium, mercury, nickel, silver, and zinc, all of the metals are less than at most about 5 times greater than the concentration (actual value or detection limit) of metals found in groundwater from Galbraith monitoring wells. Cadmium, mercury, nickel, silver, and zinc concentrations were lower than background values. In other words, average leachate/pore water test data are no more than 5 times as high as background water quality. This suggests that when attenuation processes such as adsorption of metals by underlying organic, clay-rich bay muds are factored in, leachate concentrations are likely to be reduced to below background groundwater quality values.

Table 4.2.7.6-5. Comparison of Highest Mean Value Leaching and Pore Water Test Results to Background Galbraith Golf Course Groundwater Quality Data Galbraith Golf Course Disposal Alternative

<i>Parameter (µg/l)</i>	<i>Galbraith Golf Course¹</i>	<i>Highest Mean Value²</i>
Arsenic	ND (10) - 15.3	72.1
Cadmium	< 5.0	2
Chromium	< 10 - 24	64.8
Copper	22.6 - 75.6	102.5
Lead	1 - 24.3	50
Mercury	< 0.2 - 0.28	< 0.2
Nickel	< 10 - 64.8	54.6
Silver	< 10	1.6
Zinc	< 10 - 112	104.2

- Notes:**
1. BEC 1991; HLA 1993 unpublished data.
 2. Highest mean value of leachate/pore water test results from Table 4.2.7.6-4, excluding WET results.

Finally, Inner/Outer Harbor and Turning Basin Wings sediment quality data were also compared to metals data for surficial soil samples collected at 1.0 to 1.5 feet bgs at Galbraith Golf Course (Table 4.2.7.6-6). Comparing mean values, antimony, barium, beryllium, cobalt, cadmium, lead, selenium, thallium, and zinc values were all lower than the mean concentration for Galbraith shallow soils. Mean values of arsenic, copper, mercury, nickel, and vanadium from Port sediments are enriched relative to Galbraith soils by factors ranging between 1.3 and 4.3. The mean chromium value was up to about 7 times higher than the Galbraith mean; this enrichment is attributed, at least in part, to naturally high levels of chromium found in Port sediments as discussed in section 4.2.7.5. Silver and molybdenum mean values are enriched up to a factor of about 14. These comparisons indicate that the quality of Port of Oakland sediments is generally comparable to the shallow soil already present at Galbraith Golf Course. For many metals, the quality of the Port sediments is somewhat better. This suggests that disposal of these sediments at Galbraith does not represent a significant impact on the quality of existing Galbraith soil.

**Table 4.2.7.6-6. Comparison of Port of Oakland
Inner and Outer Harbor Sediment to Shallow Galbraith Soil
Galbraith Golf Course Disposal Alternative**

<i>Parameter (mg/kg)</i>	<i>Galbraith Golf Course¹</i>	<i>Inner/Outer Harbor; Turning Basin Wings²</i>
Antimony	<3 - <89.5 (11.3)	1.2 - 18.83 (4.53)
Arsenic	<3.5 - 7.1 (4.3)	1.86 - 28.91 (8.71)
Barium	75.1 - 503 (213)	6.74 - 104 (66.92)
Beryllium	0.32 - 0.62 (0.48)	0.3 - 0.65 (0.38)
Cadmium	1.4 - 6.2 (3.5)	0.02 - 8.04 (0.77)
Chromium	41.1 - 68.1 (51.3)	106.33 - 930 (359.99)
Cobalt	9.8 - 17.0 (13.2)	7.17 - 13.73 (10.14)
Copper	12.6 - 77.8 (48.5)	9.1 - 423 (70.09)
Lead	<3.5 - 307 (113)	5.3 - 246 (48.92)
Mercury	<0.09 - 0.44 (0.15)	0.003 - 8.3 (0.65)
Molybdenum	<0.70 (0.35)	1.02 (3.5)
Nickel	33.4 - 189 (71.9)	29.3 - 212 (91.76)
Selenium	<1.6 - <3.5 (1.6)	0.08 - 6.09 (0.5)
Silver	<0.50 (0.025)	0.02 - 1.12 (0.36)
Thallium	<6.3 (3.15)	0.3 - 0.65 (1.06)
Vanadium	32.3 - 55.8 (40.6)	50 - 66.1 (55.12)
Zinc	34.9 - 538 (196)	25.3 - 549 (144.9)

Notes:

1. Range and (mean) of concentration; BEC 1991. Mean values calculated using 1/2 the detection limit.
2. Range and (mean) of concentration from Table K-6. Mean values calculated using 1/2 the detection limit.

In summary, the primary potential impacts on groundwater would be due to the release of salts, iron, and manganese from the dredged material. Recent field work at Galbraith has confirmed that shallow fresh water is present along the eastern boundary of the site. Such water will be impacted by the release of salty pore water and as leachate and pore water migrate radially from the dredged sediment disposal

ponds. The impact to shallow fresh water is expected to be of moderate duration (less than several years) and distance from the site.

The impact to shallow groundwater is not expected to be significant for the following reasons: (1) the site is principally underlain by groundwater with TDS exceeding 3,000 mg/l, the state criterion for defining a potential drinking water source; (2) salts would be readily flushed from the dredged sediments by rainfall and irrigation inflows; and (3) regional groundwater gradients are expected to flush the limited amount of saltwater that enters the fine-grained alluvial materials toward the bay (this saltwater already mimics the existing brackish groundwater quality).

Due to loading by dredged sediments on the former landfill materials, lateral spreading and migration of existing leachate fluids is expected. This impact is considered significant, especially in areas where petroleum products have been observed, but of limited lateral extent.

Impacts on Surface Water

The placement of slurried dredged sediments within a confined disposal area will cause major changes in the surface drainage of the golf course. While the site is surrounded by containment levees, drainage from within the containment area will be directed toward two weirs located on the eastern and southern containment dikes. The eastern weir will discharge decant flow to the existing brackish wetlands near the Airport Drive and Doolittle Drive intersection. Discharge from the wetlands will then be directed along Airport Drive in a wetland mitigation area toward pumphouse #4, which pumps local drainage into the bay. Decant water from the western weir will discharge into the existing drainage channel which discharges into the bay. Minor off-site drainage from a portion of the Doolittle Road right-of-way that currently enters the existing channel which bisects the golf course will also be directed toward the wetlands area near the intersection after construction of the levees. No other off-site drainage currently enters the site or will be impacted by the project.

Once the material is dried, spread, and the containment levees regraded, the site will be about 7 to 9 feet above existing grade, and the existing poor drainage conditions in parts of the Golf Course will be improved. No impacts on the flooding potential of adjacent surface waters will occur as a result of the project.

Sedimentation, erosion, and discharge controls will be incorporated into the site design to eliminate impacts on the surface water surrounding the site. Stormwater runoff best management practices (BMPs) in accordance with the National Pollutant Discharge Elimination System (NPDES) standards for construction and post-construction activities (e.g., sediment traps, straw-bale dikes, silt fences, and the re-establishment of vegetation by hydroseeding on the inboard and outboard slopes of the levees) will be utilized to control erosion and sedimentation.

The dewatering facilities will capture on-site stormwater runoff generated during site construction and the decanting and dewatering of the dredge material. The containment areas will be designed so that the retention time and depth of ponding will be sufficient to promote sedimentation and the removal of particulates, prior to the release of any water from the site. Weirs at discharge locations from the containment areas will be used to decant the surface water from the top of the dredge slurry as the deposited dredged material settles and consolidates. The release of decanted water through the weirs will be controlled by site operators so that discharges are prevented until the retained water meets RWQCB

requirements for discharge into San Francisco Bay and NPDES permit requirements for site construction activities and operations.

Comparison of modified elutriate test results with the lowest RWQCB Basin Plan marine water quality objectives (Table 4.2.7.6-7) indicates that the only potential impacts from elutriate water are for copper, lead, and TBT for sediments from the Inner and Outer Harbors and the Turning Basin. Because discharges to adjacent surface waters will be controlled by site operations until the on-site waters meet NPDES discharge standards, the project design will eliminate any potential impacts that could result from the release of elutriate water into San Francisco Bay. Retention of suspended particulates in the drying cells will remove the bulk of the constituents that may affect surface water quality. Dissolved constituents observed in the modified elutriate tests may require some dilution or treatment to meet Basin Plan water quality objectives. Dilution factors of less than 4 for the concentrations of copper and lead may be required to meet the lowest marine water quality objective. These factors are likely readily attainable at the point of discharge from the site. A dilution factor of about 50 for the concentration of TBT may be required to meet the water quality objectives. As discussed in section 4.2.7.4, TBT has been shown to degrade in estuarine waters in 3 to 13 days. The long retention time in the settling ponds will allow sufficient time to microbially and chemically degrade any TBT in the elutriate. If decant water does not meet discharge requirements, the water may be retained in the basins or other control measures implemented, as required by the RWQCB, until standards are met.

The results of simulated runoff tests (Table 4.2.7.6-7) indicate that, relative to the lowest marine water quality objectives, potential water quality impacts for copper and TBT could be expected if stormwater runoff is released, ignoring dilution by receiving waters. Dilution factors of 2.1 and 2.4 (respectively) would be required to meet these standards. The project design, which incorporates stormwater erosion and sedimentation BMPs, and a monitoring and inspection program of site discharges will eliminate the potential release and impact of contaminants in surface water runoff on adjacent surface waters. Surface runoff test results reported by Lee et al. (1993) indicate that surface runoff from Oakland Inner and Outer Harbor sediments may meet all assumed water quality standards except soluble copper. Consideration of a mixing zone in the receiving water or some form of treatment/control may be required. Any surface waters not meeting state water quality standards may be treated prior to discharge, for example, by passing the water through a limed, peat filter-absorber.

Therefore, no significant impacts on surface waters are anticipated.

Impacts on Drinking Water Supplies

Surface water at the points of effluent discharge is saline and not a potential source of drinking water as defined by the SWRCB guidelines. No significant impacts on surface water drinking water supplies are expected.

Groundwater at the site is of two types. The western two-thirds of the site contains brackish, nonpotable groundwater with TDS values well above 3,000 mg/l. The eastern third contains fresher water that is a potential but unlikely source of drinking water (i.e., TDS values are below 3,000 mg/l); however, TDS exceeds the drinking water MCL of 500 mg/l (section 3.2). Wells screened within this fresher water are also contaminated with solvents; the source of the solvents is most likely to be the upgradient regional solvent plume in San Leandro or local solvent sources at 900 Doolittle Drive, east and across the street

Table 4.2.7.6-7
Dilution Factors Necessary to Meet Basin Plan Marine Water Quality Objectives
Modified Elutriate and Surface Runoff Test Results
Galbraith Golf Course Disposal Alternative

<i>Parameter</i>	<i>Lowest Basin Plan Marine Objective¹</i>	<i>Elutriate Highest Mean Value*</i>	<i>Dilution Factor to Meet Water Quality Objective</i>	<i>Surface Runoff (Filtered) Highest Mean Value**</i>	<i>Dilution Factor to Meet Water Quality Objective</i>
Metals (µg/l)					
Arsenic	20	4.958	/a/	8.58	/a/
Cadmium	10	0.2867	/a/	0.444	/a/
Chromium (total)	—	3.993	—	1.89	—
Copper	20	33.6	1.7	5.99	/a/
Lead	5.6	19.9	3.6	0.891	/a/
Mercury	1	0.0407	/a/	0.047	/a/
Nickel	7.1	4.66	/a/	—	—
Selenium	5.0	bd	/a/	—	—
Silver	2.3	0.0267	/a/	1.08	/a/
Zinc	58	45.9	/a/	33.9	/a/
Organics (µg/l)					
PAHs	15	0.0468	/a/	—	—
TBT	0.005 ²	0.24	48	0.096	19

- Notes:** bd Below detection
/a/ Below Basin Plan shallow water effluent limitations
* Table K-4
** Table K-5
1. California Water Quality Control Board, San Francisco Bay Region. 1986. Water Quality Control Plan, San Francisco Bay Basin (Basin Plan).
 2. California Water Quality Control Board, San Francisco Bay Region. 1991. Water Quality Control Plan, San Francisco Bay Basin (Basin Plan). NOTE: This limit is for guidance only due to recent invalidation of the 1991 Basin Plan.

from Galbraith (Woodward-Clyde Consultants 1993). Also, according to Andres Godfrey of the Alameda County Flood Control and Water Conservation District, shallow groundwater (i.e., less than 100 feet deep) in the vicinity of the site (i.e., within 1/2-mile radius) is generally brackish or saline, and groundwater (shallow and deep) is not used for drinking water purposes. Although saline water leached from the sediments or drained from the containment ponds may impact relatively fresh water in the eastern third of the site, this impact is not considered significant because (1) shallow groundwater in the vicinity of the site is of poor quality and (2) groundwater in the area is not used for drinking water purposes. Impacts on the eastern side of the site are expected to be long term but of limited lateral extent. Regional gradients, which direct water to the bay, are likely to sweep saline water, locally introduced at the site to alluvial sediments, back toward the bay.

Mitigation Measures

Based on upland testing results, release of salt, metals, tributyltin, and PAHs are potentially significant impacts on surface and groundwater quality. The following management/mitigation measures may be implemented to meet water quality standards and reduce potential impacts to insignificance:

- a. If monitoring of soil pH indicates low pH conditions are developing, add lime to the problem areas to neutralize soil acidity. Addition of lime will physically and chemically stabilize the sediment.
- b. Apply NPDES best management practices for minimizing surface runoff.
- c. Treat or dilute effluent not meeting state water quality standards prior to discharge.
- d. The former landfill and proposed Galbraith dredged material drying site will be retrofitted with appropriate containment based on the requirements of the California RWQCB. The RWQCB will review the Port's proposed facility design for adequacy, according to Article 23, Chapter 15 California Code of Regulations, to confirm that proposed engineering controls adequately mitigate significant groundwater quality impacts potentially caused by leachate in the former landfill being displaced as a result of the project. Based on initial facility design, the engineering control measures will include supplementing the existing sidewall containment structures at the site to adequately attenuate the potential release of contaminants from the landfill that could significantly degrade groundwater.
- e. After project is complete, limit leachate production in former landfill by grading to prevent ponding of rainwater and direct surface runoff away from the site.

4.2.7.7 Port/Landfill

Rainfall and/or release of water from the dredged material will be handled by one or more of the following methods:

- (a) The drying site will be covered with a tarp to minimize runoff;

(b) Runoff from the site will be contained and samples tested, and treated if required to meet RWQCB discharge requirements, then discharged to the Inner Harbor; or

(c) Runoff from the site will be collected and either allowed to evaporate, or hauled to a landfill along with the dredged material, with no discharge to the Bay.

Because any discharge from the site (if it occurs) will be in accordance with RWQCB permit requirements, no significant impacts are anticipated. Water resources at the potential landfill sites would be adequately protected by the permits for those facilities, and thus do not require analysis for this project.

4.2.7.8 Montezuma Wetlands

Impacts on Groundwater

At the Montezuma Wetlands Site, disposal of sediments meeting the state criteria for use as cover and non-cover material in wetlands creation is expected to result in no significant impacts on surface and groundwater quality.

Potential impacts on groundwater during disposal at the Montezuma Wetlands Site include a temporary increase in the hydraulic head and, consequently, the potential for infiltration of slurry makeup water and pore water from the dredged sediments. As slurry water and pore water drain from the sediments, rainwater infiltrating through the sediments also could affect groundwater. Leachate test results under wetland conditions of anaerobic, reduced sediment reported by Lee et al. 1993 indicated that all assumed water quality standards may be met for both Oakland Inner and Outer Harbor sediments with the exception of arsenic, tributyltin, and mercury discharged to receiving waters. However, because low permeability sediments generally overlie shallow groundwater on the site, the potential for infiltration of leachate and pore water from the dredged materials to groundwater is considered minimal over most of the site. As discussed in section 4.2.7.4, the Port of Oakland sediment quality data do not significantly exceed the RWQCB sediment screening criteria for wetlands creation -- cover or non-cover. Additionally, pore water and leachate tests from Inner and Outer Oakland Harbor sediments, when compared to health-based freshwater municipal supply criteria and state and federal MCLs, indicate that no significant impacts could occur with the exception of salts (see section 4.2.7.4). Because shallow groundwater on the site is brackish (e.g., TDS values up to 25,000 mg/l), as discussed in section 3.2.4.8, the potential criteria exceedance for salt is not applicable. Deeper groundwater is hydraulically separated from shallow groundwater, as discussed in section 3.2.4.8, and therefore would not be affected.

Impacts on Surface Water

On-site drainage and surface runoff will be altered by placement of dredged materials over 1,800 acres of the 2,000-acre site and by construction of containment cells, cell and phase levees, resettlement and storage ponds, the subdrain system, and tidal channels. Existing perimeter levees will be repaired and maintained.

Excess water would be drawn from the sediments through the pond drainage system and a separate system of subdrains, which would require several collection trenches and/or discharge points. Potential discharge

points have not been identified, but may include the Sacramento River and/or Suisun Bay. Water from placement operations would be discharged periodically into the Sacramento River to maintain acceptable salinity concentrations for placement operations and when excess water is not needed. Decant water from the rehandling facility would be discharged into the Sacramento River or reused as makeup water. Effluent test results reported by Lee et al. 1993 indicate that effluent from placement of Oakland Outer Harbor sediments in a confinement may meet all assumed water quality standards except copper. Effluent from placement of Oakland Inner Harbor sediments in a confinement may meet all assumed water quality standards except tributyltin. Consideration of a mixing zone or some form of effluent treatment/control may be required. Surface runoff test results reported by Lee et al. 1993 indicate that surface runoff from Oakland Inner and Outer Harbor sediments may meet all assumed water quality standards except copper and arsenic. Consideration of a mixing zone or some form of runoff treatment/control may be required. Surface runoff arsenic concentrations reported by Lee et al 1993 may meet the State water quality standards for this site. Discharges during construction will be controlled until the water meets State water quality standards. After construction of containment cells and the placement of dredged material, on-site discharges would be monitored and controlled by site operations to meet State water quality standards.

Using stockpiled topsoil from the existing degraded marshland on the site will hasten the reestablishment of vegetation, thereby minimizing erosion and sedimentation during construction. Adherence to soil erosion and sedimentation controls and BMPs during site construction and operation, in combination with the containment levees and revegetation incorporated into the site design, would eliminate potentially significant releases of particulates in effluent and runoff and also the constituents bound to such particulates.

The existing site is potentially subject to flooding from daily tidal fluctuations, storm runoff from upland drainage areas, and flooding from the Sacramento-San Joaquin rivers and delta system. Maintenance of the existing levees and construction of the new drainage system on site will ensure that the project will not increase the potential for flooding of adjacent properties.

Impacts on Drinking Water Supplies

In the proximity of the Montezuma Wetlands Site, shallow groundwater is brackish and not a potential source of drinking water as defined by RWQCB guidelines (see section 3.2.7.8). No impacts on existing drinking water supplies are expected.

Mitigation Measures

At the Montezuma Wetland site, disposal of sediments meeting the SSC for use as cover and non-cover materials in wetland creation would not be expected to result in significant impacts on surface and groundwater quality. However, considerable comment was received by the RWQCB on the lack of sound technical or scientific basis for these proposed screening criteria (See Appendix L). Laboratory tests by WES on composite sediment samples indicated potential contaminant migration into effluent, surface runoff and leachate. Therefore, surface water will be monitored and discharged only after meeting State water quality standards.

- Surface water not meeting State water quality standards may be managed to reduce contaminant concentrations to meet State water quality standards prior to discharge. For example, passing surface water through a lined, peat filter-adsorber could reduce copper and tributyltin concentrations to meet water quality standards.

4.3 GEOLOGY, SOILS, AND SEISMICITY

4.3.1 Impact Significance Criteria

Impacts from geologic hazards were considered significant if the dredging or sediment disposal activities would potentially result in damage to or elimination of geologic resources with either a present or potential future value, or if project activities generated or exposed people or structures to geologic hazards.

The following geologic conditions were considered significant if they resulted in migration of contaminants from a disposal site or increased sedimentation of a local waterway:

- Active (Holocene) or potentially active (Quaternary) surface faults in proximity or on the project site. (The California state geologist considers Quaternary faults potentially active unless determined from direct evidence that they have become inactive before the Holocene Epoch.)
- Subsurface materials prone to liquefaction as a result of seismic activity.
- Subsurface materials prone to settlement as a result of seismic activity or native material compaction.

Significant impacts on soils were identified if any of the following conditions were met:

- Agricultural productivity of the soil would be reduced by disruption, displacement, compaction, or overcovering.
- Erosion rates would be increased to such a level that siltation would cause significant impacts on water quality or aquatic habitats.
- Sediments being discharged at the surface of the site would contain materials that would inhibit revegetation or result in contaminated vegetation.

As discussed above in section 4.2.4 for water quality impact significance criteria, an implicit sediment significance criterion for the aquatic disposal sites is disposal according to the evaluation requirements of the Marine Protection, Research, and Sanctuaries Act (MPRSA) and Clean Water Act (CWA). Similar to water quality impacts, sediment impacts at the ocean and Alcatraz sites would be considered not significant by this criterion, since only material deemed suitable for unconfined aquatic disposal according to the MPRSA and CWA testing requirements would be disposed of at these sites. Again, this does not apply to the Bay Farm Borrow Area (BFBA) site, since material unsuitable for unconfined aquatic disposal would be placed there, followed by capping with suitable material. In this case, it is appropriate to apply the "disposal according to evaluation results" criterion to the suitable material in the cap, not the underlying unsuitable material, since the cap material will be exposed to the water column and biological resources over the long term. By this approach, disposal at the BFBA site meets this criterion.

The principal concern regarding sediment quality at the BFBA disposal site is the ability of the cap to isolate over the long term the underlying material that is unsuitable for unconfined aquatic disposal. As discussed below (section 4.3.4.3), the cap is designed to provide such long-term isolation. However, the ability of the cap to provide this long-term isolation can only be verified through post-project monitoring over time. Until this is done, it can be stated that no adverse impacts to sediment quality at this site are expected as a result of disposal, but that at least a *potential* for sediment impacts exists at this site until an appropriate monitoring program is completed successfully. This issue is discussed further in section 4.3.4.3 and 4.4.3.3.

4.3.2 Regional

The geological impacts for the different disposal sites are very similar. All the sites are close to active faults and would be susceptible to violent ground motion in the event of an earthquake on a nearby fault. However, no known active faults pass through any of the sites; therefore, no impact from ground rupture or fault displacement is expected. The impact from severe ground motion varies with the use of the dredged material. All the sites may be susceptible to liquefaction and large amounts of settling during a seismic event. The impact on soils varies from site to site. The creation of holding/dewatering sites will impact native soils. This may be a significant impact depending on the land use of the disposal site.

4.3.3 Oakland Harbor

4.3.3.1 Project Impacts

Sediment Quality

The potential impacts to bottom sediments in the Oakland Inner and Outer Harbor dredging sites include changes in bottom topography, alterations in sediment transport processes, and a change in sediment quality (i.e., conventional and contaminant constituents) as a direct result of sediment removal. The present dredging plan calls for dredging the Oakland channels to -42 feet mean lower low water (MLLW). The deeper depths to which the berths and channels will be dredged will result in a change in topography. Fine-grained sediments present in the water column will flocculate and ultimately settle to the bottom of the dredged channel. The sediments will form a "fluff" layer which forms within the first few weeks after dredging. This layer will not be flushed from Oakland Harbor because currents exiting the channels are predominantly in the surface waters. Consolidation of this material will take place over the long-term (COE 1976, Appendix C). Another immediate effect of sediment removal includes the slumping of materials located on the channel slopes into the channel. This process will persist until side slopes equilibrate. These processes are common among maintenance dredging projects and are not considered significant.

As noted in section 4.2.6, prevailing hydrodynamic conditions in the Inner and Outer Harbors will not change after dredging has taken place. Sediment transport processes, as a result, will not substantially change. These channels will be depositional in nature and are expected to be the sites of future maintenance dredging projects.

The last change that will occur due to the removal of sediments from the Oakland Harbor channels is the potential for equal or improved sediment quality conditions in terms of contaminant constituents. These sediments, which have been intensively tested both chemically and biologically, show a wide range in

metals and organic compounds concentrations, toxicity, and bioaccumulation potential (see sections 2.4 and 3.3.2). The most contaminated sediments, typically located along the berths and in the Inner Harbor Turning Basin, will not be disposed of in-water; rather, they will be confined to upland sites and carefully controlled. These sediments failed Implementation Manual/"Green Book" ocean criteria for potential water column and/or benthic impacts (i.e., solid-phase toxicity and/or bioaccumulation tests).

The most contaminated sediments in San Francisco Bay are typically associated with Younger Bay Mud (YBM) whose depositional history includes anthropogenic inputs. Determinations of proportions of Older Bay Mud (OBM; sediments deposited over 10,000 years ago) and YBM can allow preliminary determinations of material suitability for unconfined, open-water disposal. YBM was the predominant material from the mudline to -44 feet MLLW for the Phases IIIB characterization study (Oakland Outer Harbor and portions of the Inner Harbor). A relatively thin layer of YBM covered OBM in both the berthing areas and Inner Harbor Turning Basin sediments, although OBM predominated in the proposed Inner Harbor Turning Basin site (Battelle 1992a; 1992b; 1992c). The removal of contaminated YBM will effectively "clean up" portions of Oakland Harbor. This condition could change in the long term when additional fine-grained sediments with associated contaminants refill the channels. Other potential sources of contamination include local industrial and municipal wastes inputs and the berthing ships themselves. Overall, significant impacts to sediment quality are not expected.

Seismicity

In view of the known seismic activity in the area, earthquakes will be a hazard for the life of the project. The main hazard associated with seismic activity is the channel instability. The Corps Oakland Harbor Design Memorandum Number 1 states that the shear strength of the soft, plastic clays and silts of the Harbor will accept channel side slopes with 1:3 vertical to horizontal ratio. Because of lateral constraints imposed by the needed width for the channel bottom, and the essentially fixed locations of the top of the side slopes in the Inner Harbor Channel, using a flatter side slope in the Inner Harbor Channel is not planned. A strong to large earthquake in the San Francisco Bay Area on either the San Andreas or Hayward faults would probably cause local slope failures. The 1:3 vertical to horizontal ratio for side slopes in the Outer Harbor and Oakland Bar Channels would not pose a hazard to shipping if they failed during an earthquake. Flattening the side slopes would add significantly to the quantity of material to be excavated, and consequently would increase the total construction cost. Seismically induced slope failures would, however, add to the cost of operations and maintenance.

4.3.3.2 Mitigation Measures

The lack of significant impacts to Oakland Harbor Inner and Outer Harbor sediments after dredging precludes the use of substantial mitigation measures. Ideally, all contaminated sediments would be removed from the project areas, improving sediment quality throughout. Ways to mitigate the resuspension and, ultimately, the redeposition of contaminated sediments in the channels have been discussed in the water quality impacts (section 4.2.6) and would be applicable to maintaining or improving sediment quality.

4.3.4 Disposal Site Options

4.3.4.1 Ocean Section 102

The potential impacts of disposal operations on the physical environment of the Ocean Section 102 site are based on sediment dispersion modeling results presented in EPA (1993a) and U.S. Navy (1993a). The models, in essence, determine the most probable size and height of a dredged material deposit following placement of a target volume of sediment. The two models differ somewhat in terms of target volumes and data input (i.e., current measurements, sediment texture, duration of placement). However, both models assumed dredged material behaves in a predictable manner following disposal, involving convective descent, dynamic collapse, and passive diffusion (see section 4.2.1.1).

Project Impacts

Potential sediment impacts at Ocean Section 102 include the following:

- accumulation of dredged material over a large area of the seafloor,
- a potential change in sediment characteristics (i.e., texture and chemical composition) from ambient sediments,
- changes in bottom topography, and
- changes in sediment transport processes.

Changes in bottom topography or sediment transport processes are not expected to be substantial because the thickness of the dredged material deposit (less than 50 cm) is expected to be negligible relative to the water depth of the site (almost 3,000 meters). Impacts associated with shoaling concerns common with in-Bay or nearshore disposal sites are not an issue with Ocean Section 102. Bottom currents are not expected to change course or velocity due to the low relief of the deposit. The first two bulletized impacts are unavoidable physically but their significance can only be assessed in terms of biological impacts. Rapid accumulations of sediment exceeding 10 cm in thickness have been shown to smother native benthic communities (Rhoads and Germano 1990; see section 4.4.3.1). Predicted areal coverage and thicknesses of dredged material are presented in Table 4.3.4.1-1.

As shown in Table 4.3.4.1-1, clay-silt matrices are more likely to clump and fall to the bottom in masses less likely to disperse, resulting in thicker deposits. Both studies emphasized the minimal physical impacts to the Ocean Section 102 site due simply to the extremely thin deposit that would result from disposal activities. For this project, up to 5.4 mcy of dredged material will be placed at the ocean site, resulting in a footprint reduced in both thickness and extent from the EPA's modeled deposit. If all material dredged in this project was deposited at the ocean site, volumes would approximate 50 percent sand and 50 percent silt-clay. The dredged material footprint for this project would likely fall halfway between those model-predicted thicknesses and areal coverage calculated for clay-silt and mostly sand materials.

The EPA's deposition model predicted that disposal of 6 mcy per year would result in deposits up to 49 cm for clay-silt mixtures and 6.6 cm for materials composed of mostly sand. Thicknesses of silt-clay

deposits greater than or equal to 10 cm would cover an area of 7.29 km² after one year of disposal activity. At no time would layers exceeding 10 cm be deposited instantaneously.

The U.S. Navy's study modeled the instantaneous disposal of 1.6 mcy of material. This large volume of clay-silt material (50 percent clumped) resulted in a footprint reaching a maximum thickness of 26.9 cm at the center of the deposit, covering an area of 9.9 km². This model assumes worst case (i.e., disposing of a large volume in one location all at once) and does not necessarily reflect reality.

Table 4.3.4.1-1. Model-Predicted Deposit Thicknesses, Areal Coverage, and Material Loss at the Ocean Section 102 Site

<i>Study</i>	<i>Material Type</i>	<i>Maximum Thickness (cm)</i>	<i>Percent Loss in Water</i>	<i>Area Covered</i>
EPA 1993a ¹	C-S	49	27	279 km ²
	M-S	6.6	16	449 km ²
U.S. Navy ² 1993a	50 percent clumped (clay-silt)	26.9	48	9.9 km ²
	10 percent clumped (sandy)	5.9	84	5.2 km ²

Notes:

1. EPA study modeled the release of 6 mcy of material over a one-year period. Current data based on real measurements collected from March 1991 to February 1992 (C-S = clay-silt; M-S = mostly sand). Model assumes C-S material is 50 percent clumped and disposal took place over a disposal target having a 2-km radius.
2. U.S. Navy study modeled the instantaneous release of 1.6 mcy of material and allowed for a 48-hour settling period. Current data based on real measurements collected during a 45-day period in the summer of 1990.

Monitoring of the ocean site was recently performed by the U.S. Navy to monitor sediment dispersion and deposition related to the placement of material dredged from U.S. Navy bases in the Bay. Results are preliminary but show the approximate thickness of the dredged material deposit within the release zone to be 5 cm to greater than 18 cm. Sediments carried in suspension away from the disposal site have been to the northwest. No materials entered the marine sanctuary encompassing the Farallon Islands. Additional computer modeling was used to predict the thickness and areal extent of dredged material based on actual volumes placed at the site. Assuming a total of 698,762 cubic yards of dredged material was placed at the ocean site, the average thickness predicted by the model for 10 percent clumped material was approximately 2 cm; 50 percent clumped was 10 cm; and 80 percent clumped was 16 cm. Sediment vertical profile system surveys suggested the dredged material was fine-grained and relatively clumped (U.S. Navy 1993a). Model results, then, appear to be a valid tool in predicting actual dredged material thicknesses.

Bottom sediments located at the ocean site will change in physical and chemical character in the area affected by dredged material disposal. Ambient sediments are composed of, on the average, 14 percent sand, 76 percent silt, and 10 percent clay. Oakland Harbor sediments found suitable for ocean disposal cover a wide range in grain size (6 to 95 percent silt and clay, mean = 47 percent silt and clay). If all of the material found suitable for ocean disposal was placed at Ocean Section 102, bottom sediments

would become enriched in sandier sediments. In addition, total organic carbon would reduce from 3.3 percent on average to an average concentration of 0.5 percent in the area affected by dredged material disposal assuming all suitable material was deposited at the ocean site.

In terms of contaminant constituents, Ocean Section 102 sediments demonstrated low levels of metals concentrations; and, with the exception of lindane, organic compounds were not detected. Among the composite samples determined suitable for ocean disposal, chromium, lead, PAHs (low- and high-molecular weight), and butyltins appear elevated with respect to Ocean Section 102 sediments. Other metals, such as nickel and mercury, are also elevated in some Oakland Harbor composites with respect to ocean sediments. Cadmium, in almost all cases, was higher in Ocean Section 102 sediments in comparison to Oakland Harbor sediments. Concentrations of contaminants present in the disposed material would probably be diluted by mixing of dredged material with "cleaner" composites and existing bottom sediments. In the long term, bottom sediments will gradually approach background levels due to natural sedimentation. It should be noted that, although elevated levels of bulk sediment contaminants appear in Oakland Harbor sediments, their toxicity to biota and bioavailability were determined to be "insignificant" in accordance with the Implementation Manual's (COE and EPA 1991) guidelines for determination of material suitability for ocean disposal (see sections 2.4, 4.4.3.1, 4.2.2, and 4.2.3).

Given the weight of evidence, sediment quality impacts will be insignificant, because only materials deemed suitable for unconfined, open-water disposal will be placed at the Ocean Section 102 site. Accumulation of dredged material and the associated changes in sediment characteristics will be unavoidable, although their significance can be reduced by implementation of mitigation measures. Ramifications of these impacts to aquatic life are discussed in section 4.4.3.1.

Mitigation Measures

The proposed Site Management and Monitoring Plan (SMMP) for the Ocean Section 102 Site (EPA 1993c) provides a basis for making site use management decisions using data collected in a tiered monitoring program. The plan was devised to avoid or mitigate adverse environmental impacts at and adjacent to the Ocean Section 102 Site. The SMMP also lists several provisions for site use that have been incorporated into the disposal site use permit (in the MPRSA Section 103 process) that aim to (1) restrict the inadvertent disposal of materials in transit to the Ocean Section 102 Site, (2) define a target for material release, and (3) provide guidelines for compliance monitoring of these restrictions. Provisions for the dredging contractor include the following:

TIME OF DISPOSAL

- Barges will not leave the Bay when wave heights along the transit route are predicted to exceed 18 ft. Under other less severe weather conditions, extra precautions (such as reducing the load by 15 percent) will be taken to prevent spillage or other loss of material during transit to the site.

DISPOSAL TECHNIQUE

- No disposal barge shall be filled above its load limitation, and all loads must be certified by an inspector.

- Barges with a capacity of 3,000 cubic yards will be loaded to 80 percent capacity (2,400 cubic yards) for each tug boat captain's initial 12 trips to the Section 102 site. After each captain has completed the initial 12 trips, subsequent barge loads may be filled to the load limitation, as permitted by sea conditions.
- No water or dredged material is permitted to leak or spill from the barges during transit to the Section 102 site.
- A tow speed of less than or equal to 6 knots will be used.
- Tugs with barges will remain outside of the territorial sea boundary surrounding the Farallon Islands by following the inner portion of the outbound western shipping lane for transit into and out of the Bay.
- When the disposal barge is west of the Vessel Separation Scheme (VSS), the tug shall proceed directly to the Section 102 site. The barges must be towed in transit routes that pass at least 3 nautical miles from the Farallon Islands.
- The U.S. Coast Guard's (USCG) Offshore Vessel Movement Reporting System (OVMRS), which extends 38 miles offshore Mount Tamalpais, will be used to track barges within its range.
- The tug is required to use an electronic positioning system (i.e., a miniranger system with at least two transponders or a Global Positioning System (GPS) with a minimum accuracy and precision of 100 ft (30 meters) for disposal operations. If the positioning system fails, all disposal operations shall cease until the navigational capabilities are restored.

PLACEMENT OF MATERIALS

- All material will be discharged within a 1.1-nautical-mile diameter circle centered at 37°39'N, 123°29'W.
- When dredged material is discharged, no portion of the barge shall be further than 3,200 feet from the center of the Ocean Section 102 site.

DISPOSAL MONITORING AND DOCUMENTATION

- The permittee will maintain daily records of dredging operations, transportation schedules, barge load volumes disposed, and exact location and time of disposal.
- The tug captain will maintain a copy of all weather reports and will make wind and sea observations.
- Each tug will maintain a computer printout from GPS or other acceptable navigation system showing transit routes and disposal coordinates, including the time and position of the disposal barge when the barge doors open and close.

- A Contractor Quality Control (CQC) inspector will observe all dredging operations and submit reports containing a description of operations for each barge load, a checklist, a transit route map, a printout of coordinates from each waypoint and release point, a record of radio transmission and facsimile from the tug captain on a weekly basis.
- A permittee will report any violations to EPA and to COE within 24 hours. In the event of a violation, the permittee must make all necessary changes to bring disposal operations into compliance before making another trip to the Section 102 site.
- Development and implementation of more sophisticated surveillance systems, which can be demonstrated to EPA to be effective and capable of being audited, may be substituted pending approval from EPA for one or more of the above conditions.

Evaluations and possible revisions of these generic site-use conditions will occur as needed depending on the results from the monitoring program. Additional conditions on use of the Section 102 site may be determined during the permit review process.

Following dredged material placement, a tiered monitoring approach will be used to address the effects of dredged material on the marine environment. The Physical Monitoring Plan is focused on the potential transport of dredged material from the site. Numerical modeling will predict the extent of the dredged material deposit followed by field verification sampling. Sediment quality is assessed by measuring contaminants levels on and off site. If unacceptable adverse impacts are detected, several management actions could be utilized, including reducing the size or location of the disposal zone, revising permit conditions on placement, and limiting the amounts of material disposed in a year. EPA anticipates finalizing the proposed SMMP in July 1994. The requirements of the final SMMP will be incorporated as part of the construction of the Oakland Harbor project.

4.3.4.2 Alcatraz

Project Impacts

Potential impacts to the Alcatraz disposal site sediments are those identified in section 4.3.4.1. These include the physical accumulation of sediment at the site, the potential change in sediment texture and chemical composition of the dredged material, changes in bottom topography and the resulting potential changes to sediment transport processes. Section 4.2.7.2 described disposal controls (i.e., 30-day target disposal volumes, target volumes for materials dredged using clamshell buckets) established by the Corps that minimize excessive accumulations of material at the Alcatraz disposal site (PN 93-3). Because it is anticipated that the materials placed at Alcatraz will be dredged using hydraulic cutterhead systems, sediments will be fluidized and susceptible to dispersion. Over half of the material in this fluidized state could be dispersed by local east-west currents (Teeter 1987). The material remaining at the site, up to 1.7 mcy, will consolidate with time. Sediment accumulation and alterations in bottom topography are unavoidable; however, its impact is expected to be insignificant given current site management controls. Sediment transport processes will not change because local hydrodynamics are not expected to change (see section 4.2.7.2).

The Alcatraz disposal site displays a highly heterogeneous substrate in terms of grain size characteristics and contaminants levels. The high rate of disposal activity at Alcatraz has left both cohesive, fine-grained

sediments and coarse-grained sediments as well as patches of both relatively "clean" and contaminated sediments. Concentrations of some analytes (i.e., PAHs, nickel, chromium, and mercury) generally exceed Bay-wide average concentrations (see section 3.4.3.2). In comparison to proposed Oakland Harbor dredged material, concentrations of most contaminant constituents occur above and below those measured at the Alcatraz site. The average percentage of fines (silt and clay) measured in materials deemed suitable for unconfined, open-water disposal is 56 percent, falling within the range of percent fines measured at Alcatraz (2 to 85 percent fines). Total organic carbon concentrations will, on average, remain the same.

The site, by virtue of the high rate of disposal activity occurring there, is heterogeneous in terms of sediment quality. Only materials associated with the Oakland dredging project found suitable for in-Bay unconfined, open-water disposal will be placed at Alcatraz, precluding significant impacts to site sediments.

Mitigation Measures

No significant impacts to Alcatraz sediment quality are anticipated at Alcatraz, however, standard material disposal controls described in PN 93-3 should be implemented. Implementation of these operational controls will eliminate potential hazards to navigation caused by substantial accumulations of sediment at the site. As with any disposal plan, strict positional controls should be implemented to confine disposal operations within the disposal site boundaries. Positional logs should be maintained and spot inspections should be performed during disposal operations.

4.3.4.3 Bay Farm Borrow Area

Project Impacts

The types of potential impacts to the BFBA sediments have been described for the other aquatic disposal sites (see sections 4.3.4.1 and 4.3.4.2) and include rapid accumulations of sediment in the BFBA, a potential change in sediment characteristics, and changes in the bottom topography that may affect sediment transport processes. As noted in section 4.2.6.1, although the pit will become more shallow with the addition of dredged material, the site will not be filled completely and will remain as a topographic low in the area. Bottom currents are not expected to change substantially, and the site will remain depositional in nature. Potential sediment impacts of concern are burial of existing sediments (and associated biological life), and changes in the texture and chemical composition of sediments by the addition of dredged material.

The physical impact involving the addition of dredged material to the pit is unavoidable. Water depths within the pit will decline, on average, by 11 feet. This minimal change in bottom elevation will not create a navigation hazard because the BFBA capping design excludes the placement of a dredged material mound. Biological impacts as a result of rapid burial are discussed in section 4.4.3.3.

The BFBA disposal site alternative is unique in that the current plan may involve the disposal of material unsuitable for in-Bay disposal prior to cap placement. Ambient sediments located in the pit show evidence of anthropogenic inputs; metals (especially mercury, chromium, and lead) and PAHs have been detected in sediments collected there during seasonal surveys of the BFBA (OBAI 1990, 1991; SAIC 1992a-d, 1993a). Concentrations of these contaminants, however, do not exceed bay-wide concentrations.

In comparison to proposed Oakland Harbor sediments found suitable for open-water disposal (i.e., capping material), the mean concentration of total high PAHs in BFBA pit sediments (1,206 ppb dry weight) falls within the ranges of total high PAH concentrations measured in sediments deemed suitable for open-water disposal (7 to 3,120 ppb dry weight). Among metals, BFBA sediments demonstrated generally higher concentrations of mercury, selenium, and zinc than those Oakland Harbor sediments found suitable for disposal. Chromium concentrations in Oakland sediments were higher than BFBA sediments, and the remaining metals were detected at concentrations above and below mean values measured in pit sediments. Sediments within the pit may improve in quality for certain metals (mercury, selenium, and zinc) with the addition of dredged material found suitable for in-Bay disposal. Sediment texture will change from predominantly fine-grained sediments (83 percent fines) to a silt/clay and sand mixture (56 percent fines) following cap placement. Total organic carbon content will, for the most part, remain the same (around 1.2 percent).

If the BFBA is used as a confined aquatic disposal site, materials found unsuitable for unconfined open-water disposal will first be placed at the site where overall contaminants levels of ambient BFBA sediments may become degraded. These impacts are expected to be short term because cleaner cap materials will be placed over the contaminated sediments. The cap placed at the site is expected to isolate contaminated sediments for a minimum of 50 years; however, management of the confined aquatic disposal site would continue indefinitely. It should be noted that for some parameters, such as mercury, sediment quality will actually improve with the deposition of unsuitable material. Because, in the confined aquatic disposal scenario, unsuitable materials will be capped with suitable sediments, no significant impacts are expected at the BFBA due to degraded sediment quality (in accordance with the sediment impact significance criteria, section 4.3.1). However, the ability of the cap to provide long-term isolation can only be verified through post-project monitoring over time. Until this is done, it can be stated that no adverse impacts to sediment quality at this site are expected as a result of disposal, but that at least a *potential* for sediment impacts exists at this site until an appropriate monitoring program is completed successfully.

Mitigation Measures

Significant adverse impacts to sediment quality are not expected if unsuitable materials are properly capped with suitable sediments. Disposal and cap placement controls described in section 4.2.7.3 apply in this section as well; no additional mitigation measures would be required. The most important mitigation measure will be to minimize the length of time between placement of contaminated sediments and cap materials.

4.3.4.4 Leonard Ranch/Redwood Landfill

Potentially significant seismic impacts may occur at the Leonard Ranch site, if a large magnitude earthquake occurred on a nearby fault. In such an event, severe ground motion and liquefaction could occur. Earthquake-induced levee failure at the site could cause geologic hazards on SR 37 and the adjacent railroad tracks.

Leonard Ranch Rehandling Option

IMPACTS. The seismic hazards for this site are expected to be the same as those described for the region. If a large magnitude (5.0 - 7.0 Richter scale) earthquake occurred on a nearby fault, the sediment

rehandling site could potentially have severe ground motion and liquefaction. This could cause a number of problems for the levees, which will be constructed on unconsolidated on-site soil and sediments. The physical impacts of these geologic hazards on SR 37 and the adjacent railroad tracks could be significant. Such an event is not likely to occur during the short time Port of Oakland sediment is drying (2 to 4 years), but is possible over the 30-year life of the facility.

Settlement of the underlying bay mud may occur as a result of the dredged sediments being left on-site for an extended period of time. Although this potential impact could be significant, the amount of settlement may be reduced by using appropriate engineering controls (i.e., limit the amount of sediment drying at one time).

The agricultural use of soil on the site will be impacted. Compaction by construction equipment and overcovering of existing soil will create a loss of agricultural production. In addition, saltwater from overlying dredged sediments may infiltrate into the existing soil and increase the salt content of the soil. The intended ultimate land use of the site is agriculture and/or seasonal wetlands. Conversion of this land to wetlands is consistent with the goals of the Sonoma Baylands Enhancement Plan. Therefore, affecting the agricultural use of the soil is not considered a significant impact.

Mitigation Measures

Although potential impacts of geologic hazards to the levees for the duration of the project are considered not significant, the levees should be designed so that, in the event that a failure occurs resulting from an earthquake, the road and tracks will not be significantly affected.

Based on an evaluation of the soil conditions at the rehandling site, appropriate engineering controls should be implemented to reduce potential settlement of surrounding facilities.

4.3.4.5 Sonoma Baylands

Project Impacts

No potentially significant seismic impacts are expected to occur at the Sonoma Baylands site.

The geologic and seismic hazards identified in the regional section are applicable to the Sonoma Baylands disposal site. If a large magnitude (5.0 to 7.0 Richter scale) earthquake occurs on a nearby fault, severe ground motion and liquefaction could occur at the site. However, potential seismic impacts at the site are considered minimal, because the site will be unpopulated as a result of its conversion to tidal marshland. Placement of the levee 100 feet from the railroad tracks will eliminate any potentially significant impact from earthquake-induced failure of the levee.

Soil erosion rates on new levee exteriors could increase during the first rainy season after placement if adequate grass cover has not been established. However, the interior peninsulas and southern levee are intended to erode during the conversion process to tidal marshland. New northern levees are intended to prevent flooding off site. Levee failure resulting from increased erosion rates on northern levees before adequate grass cover is established is not expected because the slopes will be moderate (5 horizontal:1 vertical) and the surfaces hydroseeded; no significant impacts are expected.

Some settlement of the underlying *in situ* bay mud may occur as a result of the weight and physical characteristics of the dredged sediments to be deposited. Because of the site's intended use as tidal marshland, potential settlement is a natural and desired occurrence and is not considered a significant impact.

The ability to restore agricultural use of soil on the site will be affected. Topsoil on site will be scraped, stockpiled, and placed on the levees as cover material to provide appropriate soil conditions for plant growth. Topsoil will not be replaced over the site; dredged sediments will be spread over the site after the topsoil is removed to raise the surface elevation to accelerate the development of intertidal wetlands as part of a proposed marsh creation/restoration project. As the proposed future use of the site is intertidal wetlands, the impacts to the agricultural productivity of the soil are considered not significant.

Following the breaching of the perimeter levees, full tidal circulation would gradually develop over the previously diked site, and tidal channels will evolve by differential erosion and accretion on the adjacent mudflats. The excavated levee breaches will initially act as sediment traps until adjacent tidal creek dimensions enlarge to a size that will promote scouring of the breaches. The site itself will behave as a net sediment sink, and would accrete to elevations of the adjacent tidal salt marshes. A natural overburden of approximately 1.5 feet will develop over most of the dredged material. Once equilibrium is reached through the levee breach with the adjacent tidal marsh channels, remobilization of the dredged material will begin to occur.

Surface sediments samples obtained from the tidal marsh area adjacent to Sonoma Baylands (Lee et al. 1991), show that these sediments contain levels of contaminants below the ranges acceptable for the RWQCB Sediment Screening Criteria for wetlands creation noncover and wetlands cover/levee restoration and landfill daily cover. Based on this comparison of the quality of the dredged material and the quality of the existing tidal marsh sediments adjacent to the site, no significant impact is anticipated.

Mitigation Measures

To minimize soil erosion rates on the levees, Best Management Practices (BMPs) for erosion control shall be implemented, which include the seeding of levee slopes with native and/or naturalized grasses. Implementation of these BMPs will reduce soil erosion rates to nonsignificant levels.

4.3.4.6 Galbraith Golf Course

Project Impacts

Potentially significant seismic impacts may occur at the Galbraith Golf Course site, if a large magnitude earthquake occurred on a nearby fault. In such an event, severe ground motion and liquefaction could occur. As a result, earthquake-induced levee failure at the site could cause geologic hazards on surrounding features such as Airport Road, the FAA landing lights, an East Bay Municipal Water District reclaimed water pipeline, Doolittle Drive, the interior drainage canal, and the San Leandro Wastewater Treatment Plant.

The Galbraith Golf Course disposal site will have the same geological and seismic hazards as outlined in the section 4.3.2. If a large magnitude (5.0-7.0 Richter scale) earthquake occurred on a nearby fault,

the disposal site could potentially experience severe ground motion and liquefaction. Despite the potential for severe ground motion and liquefaction, the impacts from these geologic hazards on this site are considered minimal, because at the time of the site placement and/or drying, the site would be unpopulated. Exterior levees will be constructed at a sufficient distance from surrounding improvements so that in the event that a failure occurs resulting from an earthquake, they will not be affected. When populated by future golf course users and structures, seismic damages and hazards can be reduced by application of standard soil and structural engineering techniques. Therefore the impacts are considered insignificant.

The Port sediments will be dried on site and most of the area of the golf course would eventually be covered with a layer of clean fill. Soil erosion rates could increase on levee exteriors during the first rainy season after placement because adequate grass cover may not have been established. The flat topographic nature of the course would keep the increases in erosion rates low. BMP for erosion will be used during grading of the dried dredged material, especially during the rainy season, to minimize erosion and sedimentation. Sediment quality should not significantly impair revegetation and landscaping efforts. Topsoil will then be placed on top of the dried graded dredged sediments.

Settlement of the bay mud beneath the site is anticipated. The weight of the dikes and dredged material will cause a settlement ranging from 2 to 4 feet within 1.5 years of placement of the dredged material. Impacts to adjacent off-site properties should be minimal. The San Leandro Wastewater Treatment facility should not be impacted since settlement has already occurred in that area due to the loads induced by the existing landscaping mounds. Airport Drive is located at least 60 feet from the toe of the proposed dike. A geotechnical analysis has predicted that only 0.5 inch of settlement will occur at 40 feet from the dike; therefore neither the road or gray water line will be significantly impacted. The Federal Aviation Administration (FAA) landing lights will not be impacted by settlement, since they are located in an area of no debris fill and minimal thickness of underlying Bay Mud. Off-site settlement impacts are therefore not considered significant.

Mitigation Measures

To minimize soil erosion rates on the levees, BMPs for erosion on levees should be implemented, which may include:

- a. adequate soil compaction, and
- b. establishment of an early vegetative cover.

Although potential geologic impacts on the levees are considered minimal (e.g., the likelihood of a major earthquake occurring during the disposal/drying period is minimal), the levees will be designed using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.

4.3.4.7 Port/Landfill

There would be no impact on geology, soils, or seismicity from use of the Port site at the Ninth Avenue Terminal. Any geologic impacts at any of the landfill sites would be adequately mitigated through the permit conditions of those facilities, so they do not require analysis for the proposed project.

4.3.4.8 Montezuma Wetlands

Project Impacts

Potentially significant seismic impacts may occur at the Montezuma Wetlands site, if a large magnitude earthquake occurred on a nearby fault. In such an event, severe ground motion and liquefaction could occur. Earthquake-induced levee failure at the site could cause geologic hazards on Fire Truck Road or Dinkelspiel Road, if a levee were constructed near these roads.

The seismic hazards for this site are expected to be the same as those described for the region. If a large magnitude (5.0 - 7.0 Richter scale) earthquake occurred on a nearby fault, severe ground motion and liquefaction could occur at the site. However, potential seismic impacts at the site are considered minimal because the site will be unpopulated as a result of its conversion to tidal marshland. The physical impacts of these geologic hazards on Fire Truck Road or Dinkelspiel Road could be significant in the event of levee failure. Although potential geologic impacts on the levees are considered minimal (e.g., the likelihood of a major earthquake occurring during the disposal/drying period is minimal), the levees should be designed using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.

Settlement of the underlying bay mud may occur as a result of the weight and physical characteristics of the dredged sediments to be deposited. Because of the site's intended use as tidal marshland, potential settlement is a natural and desired occurrence at the site. However, placing dredged sediments next to existing facilities such as the Montezuma Slough levee or Fire Truck Road would induce some settlement of these fill areas. Geotechnical analyses indicate that the additional settlement caused by this load should be less than 22 inches over a 50-year period. This settlement should be masked by the continuing settlement of the existing embankment loads. Although some additional maintenance activities would be required because of the sediment placement, the potential impacts are considered insignificant.

In general, the relatively level topographic nature of the site would keep the increases in erosion rates low. Soil erosion rates on new levee exteriors could increase during the first rainy season after placement if adequate grass cover has not been established. However, levee failures resulting from increased erosion rates are not expected because the slopes would be moderate (5 horizontal: 1 vertical) and the surfaces hydroseeded. Salt-tolerant plant species would be used. No significant impacts are expected.

Sediments to be discharged at the surface of the site are expected to meet the SWRCB criteria for use as cover in wetlands creation (see section 2.8). Therefore, it is expected that sediments being discharged at the surface of the site would not contain materials that would inhibit revegetation.

Mitigation Measures

Although potential geologic impacts on the levees are considered minimal (e.g., the likelihood of a major earthquake occurring during the disposal/drying period is minimal), the levees should be designed using standard geotechnical engineering practices to prevent catastrophic impacts on adjacent facilities in the event of failure.

To minimize soil erosion rates on the levees, BMPs for erosion control shall be implemented, which include:

- a. addition of topsoil,
- b. adequate soil compaction,
- c. establishment of an early vegetative cover (hydroseeding), and
- d. use of salt-tolerant plant species.

Implementation of these BMPs will reduce soil erosion rates to insignificant levels.

4.4 BIOLOGICAL RESOURCES

4.4.1 Biological Testing Requirements for Dredged Material

4.4.1.1 Ocean Disposal Testing Requirements

Section 103 of the MPRSA specifies that material dredged and transported to a designated ocean disposal site must be evaluated to determine its potential impact to the site and its environs. The evaluation is performed in accordance with criteria contained in 40 CFR 227.27, and implementation of the evaluation is described in the *Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual* ("Green Book") developed jointly by the EPA and the Corps (COE/EPA 1977, revised in 1991). The objective of the testing program is to determine whether disposal in designated ocean disposal sites can occur (i.e., whether or not materials are found suitable for disposal) without causing unreasonable degradation or endangerment of the environment. The regulations and criteria, however, are based on the premise that a certain amount of environmental degradation or change is acceptable within the boundaries of the disposal site. The degree of change is linked to water quality criteria and limiting permissible concentrations (LPCs) of the dredged material or toxic constituents, below which impacts are believed to be insignificant.

The protocol for determining the suitability of dredged material for ocean disposal (40 CFR 227.13) is shown in Figure 4.4.1.1-1. There are obvious cases where dredged material is not considered chemically contaminated and would, therefore, cause negligible pollutional impact when discharged at an appropriate disposal site. Thus, material that meets the requirements of paragraph 40 CFR 227.13(b) may be excluded from the technical evaluations required by Section 40 CFR 227.13 and need be evaluated only in terms of its compatibility with the disposal site and the considerations of 40 CFR Subparts C, D, and E and the appropriate sections of 40 CFR 228.

Dredged material that does not meet the conditions for exclusion of 40 CFR 227.13(b) must receive a full technical evaluation of its potential for environmental impact. The evaluative procedures emphasize biological effects, rather than simple chemical presence, of possible contaminants. Dredged material is separated for evaluation into three phases, as defined in 40 CFR 227.32(b)(1). The liquid phase and the suspended particulate phase are considered to have the greatest potential for impact on the water column and are evaluated with this in mind. The solid phase has the greatest potential for impact on benthic organisms, and evaluative emphasis is placed there. All three phases must be evaluated and, when complete, satisfy the general criteria for evaluating environmental impact from constituents prohibited from dumping except as trace contaminants.

The testing manual (EPA/COE 1991) describes a tiered testing approach to implement the MPRSA (Section 103) regulations. The tiered approach involves four tiers, any of which may allow determination of suitability. The tiered tests and evaluation guidelines are summarized in Table 4.4.1.1-1. Tier I uses existing information, and Tier II uses relatively quick and simple procedures for assessing impacts. For dredged materials with either readily apparent potential for environmental impact or no impact, Tier I may provide adequate information for a suitability decision. Tiers III and IV involve more extensive evaluation for dredged materials having less clear potential for impact or for which historical data are unavailable. More intensive evaluation procedures are prescribed with successive tiers. It is important to note that testing at each tier is not required for every situation. If there is reason to believe that

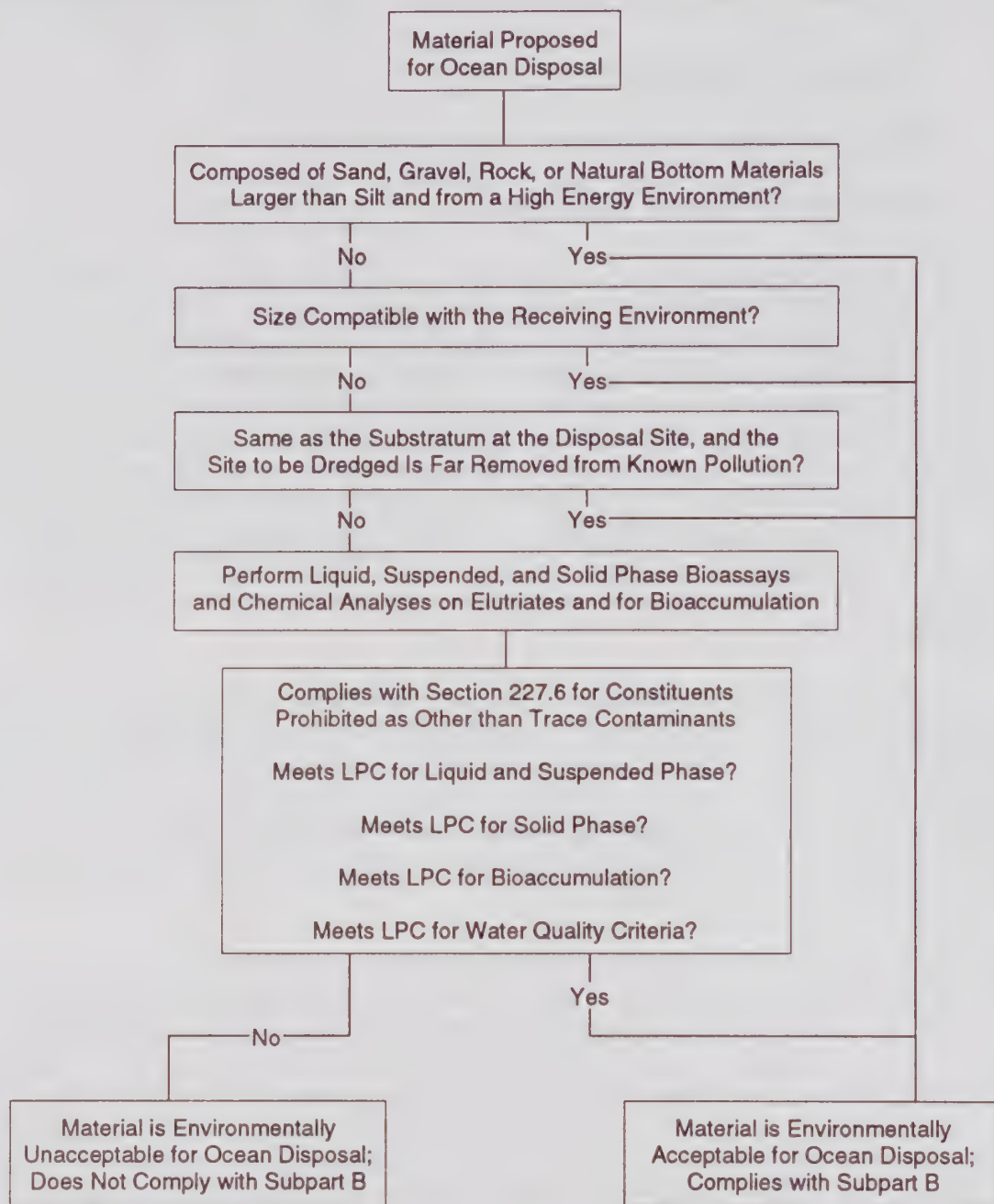


Figure 4.4.1.1-1

**PROTOCOL FOR DETERMINING SUITABILITY OF DREDGED MATERIAL FOR OCEAN DISPOSAL
(40 CFR 227.13)**

Table 4.4.1.1-1. Implementation Manual's Tiered Testing Approach
(page 1 of 2)

<i>Tier</i>	<i>Objective</i>	<i>Test</i>	<i>Interpretive Guideline</i>	<i>Action Item (when exceedances noted)</i>
<u>Tier I</u>	Evaluate existing information	Review Data	Compare data to 3 exclusionary criteria	If exclusionary criteria are not met and information cannot determine compliance with LPCs, enter Tiers II, III, or IV
	Identify contaminants of concern	Review Data	Tiers II, III, or IV-type prior data are reviewed to determine compliance with LPCs	If exclusionary criteria are not met and information cannot determine compliance with LPCs, enter Tiers II, III, or IV
<u>Tier II</u> Water Column	Evaluate marine water-quality criteria (WQC) compliance using numerical mixing model	Model	> WQC, bulk analysis screen, or elutriate do not exceed criteria	If WQC are exceeded, LPC is not met.
<u>Tier II</u> Benthos	Evaluate potential benthic impact using calculations of theoretical bioaccumulation potential (TBP) of nonpolar organics	Model	TBP > TBP of reference	Determine compliance with bioaccumulation aspects of benthic criteria
<u>Tier III</u> Water Column	Evaluate toxicity of suspended and dissolved portions of contaminants and dredged material (after initial mixing)	Elutriate Bioassays (one species each representative of phytoplankton or zooplankton, crustacean or mollusc, and fish)	Model: Concentration of dissolved plus suspended contaminants > 0.01 of the LC50 beyond the boundaries of the disposal site at any time, or anywhere after the 4-h initial mixing period	Exceeds LPC for water column toxicity
<u>Tier III</u> Benthos	Evaluate acute and chronic toxicity for benthos using bioassays	Whole - Sediment Bioassays (filter - feeding, deposit-feeding and burrowing species)	Mortality is statistically greater than in the reference sediment and exceeds mortality in the reference by at least 10% (20% for amphipod bioassays).	Exceeds LPC for benthic bioassay criteria (in rare cases, Tier IV)

Table 4.4.1.1-1. Implementation Manual's Tiered Testing Approach
(page 2 of 2)

<i>Tier</i>	<i>Objective</i>	<i>Test</i>	<i>Interpretive Guideline</i>	<i>Action Item (when exceedances noted)</i>
<u>Tier III</u> Benthos (cont.)	Evaluate the benthic bioaccumulation of chemicals of concern	Bioaccumulation tests (filter-feeding, deposit-feeding and burrowing species)	Compare tissue chemistry results to FDA Action Levels (a) If one or more contaminants of concern are statistically greater than FDA Action Levels, LPC is exceeded. (b) If all contaminants of concern are not statistically greater than FDA Action Levels or there are no FDA levels for all contaminants, determine if tissue concentrations statistically exceed those of organisms exposed to the reference sediment.	(a) Exceeds LPC for bioaccumulation (b) Further Evaluation is required in Tier III. Case specific evaluative criteria determined by EPA/COE (see interpretive guideline)
4.4.4	<u>Tier IV</u> Benthos	Evaluate long-term effects of exposure to dredged material	Case-specific	Case specific evaluative criteria determined by EPA/COE
	Evaluate benthic bioaccumulation	Bioassays using infaunal organisms		
		Steady-state bioaccumulation tests	Compare tissue chemistry results to FDA Action Levels (a) If one or more contaminants of concern are statistically greater than FDA Action Levels, LPC is exceeded. (b) If all contaminants of concern are not statistically greater than FDA Action Levels or there are no FDA levels for all contaminants, determine if tissue concentration statistically exceed those of organisms exposed to the reference sediment.	(a) Exceeds LPC for bioaccumulation (b) Further Evaluation is required in Tier IV.
		Use results of Tier IV bioaccumulation tests	Tissue concentration statistically exceed those of field-collected organisms.	Case specific evaluative criteria determined by EPA/COE.
		Collect field benthic organisms		Determine LPC compliance.

contamination is a strong possibility and historical data are not available to support a decision, testing can begin at Tier II or III. Tiers may be conducted simultaneously when time constraints are an issue. The program is intended to be as flexible as possible and consider dredging projects on a case-by-case basis.

4.4.1.2 In-Bay Disposal Testing Requirements

Use of dredged material for in-Bay disposal is regulated by Section 404 of the CWA, which requires a permit for the discharge of dredged or fill material into the waters of the United States. All applications to permit discharges of dredged or fill material are considered according to the 404(b)(1) guidelines. A Section 404 permit is required when dredged material is disposed in either an aquatic or nearshore environment. It is also required when dredged material will be hydraulically placed in an upland environment and effluent from the disposal will be returned to navigable waters.

The 404 guidelines evaluate potential disposal sites based on potential impacts on the physical, chemical, and biological characteristics of the aquatic environment. The 404 guidelines specify four conditions for any permit.

- There must be no other practicable alternatives that would have less adverse impacts on the aquatic environment.
- The disposal must not result in violations of applicable state water quality standards, toxic effluent standards, or marine sanctuary requirements.
- The disposal must not cause or contribute to significant degradation of the waters of the United States.
- The permit applicant must show that all appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic environment.

For disposal of dredged material in San Francisco Bay, additional guidance is provided by Public Notice 93-2 from the San Francisco District Corps of Engineers. This notice provides guidance regarding the number of samples of the dredged material to be tested, the chemicals of concern and test organisms to be used in tests, test report format, and use of the Alcatraz "environs" as a reference for test evaluation.

4.4.1.3 Differences between MPRSA Section 103 and Clean Water Act Section 404(b)(1)

With regard to the evaluation of contaminant status and determination of acceptable disposal options, there is general similarity between the CWA at 40 CFR Part 230 and the MPRSA at 40 CFR Part 227. Both use effects-based approaches. However, there are a number of significant differences between the CWA and the MPRSA which can play a key role in the testing and evaluation of sediments proposed for open-water disposal. These are discussed below. It should be noted that a national testing manual for the CWA is being prepared by EPA and the Corps. This manual, expected to be released to the public in the summer of 1994, will eliminate many of the apparent differences between the two testing programs.

General Guidance

The testing and evaluatory guidance in the CWA is very general and quite brief. Subpart G of the Section 404 guidelines is slightly over one page in length. In contrast, Part 227 of the MPRSA consists of over six pages of detailed technical guidance on testing and evaluation. Although this detailed guidance limits flexibility, it does provide a consistent framework because the regulation carries the force of law while guidance or implementation manuals are merely advisory. Guidance or implementation manuals must be in accord with applicable regulations.

Chemical Comparisons

The CWA clearly allows a chemical inventory to be used in the evaluation of dredged material. Concentrations of contaminants in the material are compared to those at the disposal site and, if they are substantially similar, discharge may be permissible (40 CFR 230.60(c) and (d)). For ocean disposal, 40 CFR 227.132(b)(3)(i) and (ii) would seem to allow such a comparison. However, this has generally been interpreted to be a physical comparison, rather than a chemical comparison.

Trace Contaminants

Under the MPRSA, certain constituents are prohibited if present as other than trace contaminants (40 CFR 227.6(a)(1), (2), (3), (4), and (5)). These constituents are organohalogen compounds, mercury and mercury compounds, cadmium and cadmium compounds, oil of any kind or in any form, carcinogens, mutagens, or teratogens. Numerical limits or values are not provided for the trace contaminants. Rather, the potential for significant undesirable effects is determined through the use of bioassays (40 CFR 227.6(b), (c), and (d)). There is no counterpart to the trace contaminant requirement in the CWA.

Toxicity Criteria

In the interpretation of bioassay data, the MPRSA specifies that the 95 percent confidence level is to be used (40 CFR 227.6(c)(2) and (3)). No comparable guidance exists in the CWA and, theoretically, any confidence level could be used. However, it is standard scientific practice to use the 95 percent confidence level and it has been proposed in the draft 404 Manual.

Mixing Criteria

There is provision for mixing in both the CWA and the MPRSA. In the CWA the guidance is found at 40 CFR 230.3(m) and 230.11(f)(2). As with most other guidance in the CWA, it is quite broad and general and, in essence, merely requires that the permitting authority take mixing into account when evaluating elutriate tests or water column bioassays. The MPRSA, in contrast, presents a detailed discussion of mixing at 40 CFR 227.27(a), (b), and (c).

State Authority

Under the provisions of Section 401 of the CWA, states are to provide water quality certification for the discharge of dredged material. This certification covers not only open water disposal but discharges from confined disposal facilities as well. There is no comparable authority under the MPRSA except that,

where there is geographic overlap between the CWA and the MPRSA, the Corps will voluntarily, as a matter of comity, apply for water quality certification (33 CFR 336.2(c)).

Exclusions

It is important to note that the CWA and MPRSA exclusion criteria are not identical. As previously discussed, the CWA clearly allows a chemical comparison of the dredged material to reference site sediments; the MPRSA *may* allow such a comparison.

Chemical sediment data may be used to verify that the dredged material and disposal site environs are sufficiently similar so as to preclude further testing. Should it be thought or known that they are different, chemical sediment data are useful in Tier II to model contaminant release and conduct the theoretical bioaccumulation potential calculations. Finally, a knowledge of what is in the sediment can guide the evaluation of contaminants if bioaccumulation testing is carried out in Tier III.

It should be pointed out that there is no requirement that any sediment chemistry be performed in CWA or MPRSA evaluations. In general, because they can be used to establish exclusion from further testing, such data are more useful in CWA evaluations. If, in Tier I, it is concluded that Tier III testing will be needed, there is little need to conduct a sediment chemical inventory. In such cases, Tier II would consist of the elutriate analysis to determine compliance with water quality standards (CWA) or criteria (MPRSA).

In conducting chemical analyses, only contaminants of concern should be evaluated. These will generally be taken from the list of priority pollutants and 301h pesticides. Again, reason to believe should constitute the basis for analyses. Many of these contaminants are related to specific industries or processes and, if the industries or processes are absent, the specific contaminants associated with them should also be absent.

4.4.1.4 Testing of Oakland Harbor Sediments

Between 1988 and 1993, a total of 114 sediment samples were tested according to Green Book procedures in the Inner and Outer Oakland Harbors (Table 4.4.1.4-1) for the -42 ft. project. These included the following:

- Solid phase acute test, bedded sediment tests using clams, polychaete worms, amphipods and fish.
- Suspended particulate bioassays with larval bivalves, mysid shrimp, and fish.
- Bioaccumulation testing using both the 10- and 28-day procedures with bivalves and/or polychaetes.
- Sediment chemistry test for conventional parameters and contaminants.

Table 4.4.1.4-1. Tier III, Sediment Testing Conducted for the Oakland Harbor 42-Foot Project

Oakland Harbor Study	Number of Samples	Solid Phase				Suspended Particulate Phase			Bioaccumulation			Sediment Chemistry	Comment
		10-day Bivalve	10-day Polychaete	10-day Amphipod	10-day Fish	48-hour Larval	96-hour Mysid	96-hour Fish	10-day Bivalve	28-day Bivalve	28-day Polychaete		
1988; -42 ft. Phase I	20	✓	✓	✓					✓			✓	Inner Harbor
1988; -42 ft. Phase II	21	✓	✓	✓					✓			✓	Inner and Outer Harbor
1990; -42 ft. Phase IIIA	35	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	Inner and Outer Harbor
1990; -42 ft. Phase IIIB	18	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	Inner and Outer Harbor
1993; -42 ft. Phase IIIB	20	✓	✓	✓		✓	✓	✓		✓	✓	✓	Inner and Outer Harbor

Bivalve = *Macoma nasuta*

Polychaete = *Nereis caecoides*

Amphipod = *Rhepoxynius abronius* and/or *Ampelisca abdita* and/or *Grandidierella japonica*

Fish = *Citharichthys stigmaeus*

Larval = *Crassostrea gigas* or *Mytilus edulis*

Mysid = *Holmesimysis sculpta*

Phase I (Word et al. 1990a)

In summer 1988, 20 stations were sampled in Oakland Inner Harbor. Solid-phase testing included a 10-day flow-through test with *N. caecoides* and *M. nasuta*; a 10-day static test with *R. abronius* and *A. abdita*; and a 10-day flow-through test with *R. abronius* and *A. abdita*. Tissue samples were extracted from *M. nasuta* after a 10-day exposure to the sediment treatments and a two-day depuration period. Sediment chemistry parameters included conventional parameters, polynuclear aromatic hydrocarbons, chlorinated pesticides, polychlorinated biphenyls, chlorinated pesticides, metals, and butyltins. Tissue chemistry parameters measured in *M. nasuta* tissues included polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, metals, and butyltins.

Phase II (Word et al. 1990b)

In fall 1988, six stations in Oakland Inner Harbor and 15 station in Oakland Outer Harbor were collected for testing. Solid-phase testing included a 10-day flow-through test with *N. caecoides* and *M. nasuta*; a 10-day static test with *R. abronius* and *A. abdita*; and a 10-day flow-through test with *R. abronius* and *A. abdita*. Tissue samples were extracted from *M. nasuta* after a 10-day exposure to the sediment treatments and a two-day depuration period. Sediment chemistry parameters included conventional parameters, polynuclear aromatic hydrocarbons, chlorinated pesticides, polychlorinated biphenyls, metals, and butyltins. Tissue chemistry parameters measured in *M. nasuta* tissues included polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, metals, and butyltins.

Phase III A (Word et al. 1992)

In summer 1990, 35 stations in Oakland Inner and Outer Harbors were sampled for testing. Solid-phase testing included a 10-day and 28-day flow-through test with *N. caecoides* and *M. nasuta*; a 10-day flow-through test with *C. stigmaeus*; and a 10-day static and flow-through test with *R. abronius*. Suspended-Particulate-Phase (SPP) testing included a 96-h static test with the mysid *H. sculpta*; a 96-h static test with the sanddab *C. stigmaeus*; and a 48-h static test with the larvae of the oyster *C. gigas*. Tissue samples were extracted from *M. nasuta* and *N. caecoides* after a 28-day exposure to the sediment treatments and a two-day depuration period. Sediment chemistry parameters included conventional parameters, polynuclear aromatic hydrocarbons, chlorinated pesticides, polychlorinated biphenyls, metals, and butyltins. Tissue chemistry parameters measured in *M. nasuta* tissues included polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, metals, and butyltins.

Phase III B (Kohn et al. 1992)

In fall 1990, 18 stations in Oakland Inner and Outer Harbors were sampled for testing. Solid-phase testing included a 10-day and 28-day flow-through test with *N. caecoides* and *M. nasuta*; a 10-day flow-through test with *C. stigmaeus*; and a 10-day static and flow-through test with *R. abronius*. SPP testing included a 96-h static test with the mysid *H. sculpta*; a 96-h static test with the sanddab *C. stigmaeus*; and a 48-h static test with the larvae of the mussel *M. edulis*. Tissue samples were extracted from *M. nasuta* and *N. caecoides* after a 28-day exposure to the sediment treatments and a two-day depuration period. Sediment chemistry parameters included conventional parameters, polynuclear aromatic hydrocarbons, chlorinated pesticides, polychlorinated biphenyls, metals, and butyltins. Tissue chemistry parameters measured in *M. nasuta* tissues included polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, metals, and butyltins.

Intensive Study (Pinza et al. 1993)

In spring 1993, 20 stations in Oakland Inner and Outer Harbors were sampled for testing. Solid-phase testing included a 10-day and 28-day flow-through test with *N. caecoides* and *M. nasuta*; and a 10-day static test with *R. abronius*. SPP testing included a 96-h static test with the mysid *H. sculpta*; a 96-h static test with the sanddab *C. stigmaeus*; and a 48-h static test with the larvae of the mussel *M. edulis*. Tissue samples were extracted from *M. nasuta* and *N. caecoides* after a 28-day exposure to the sediment treatments and a two-day depuration period. Sediment chemistry parameters included conventional parameters, polycyclic aromatic hydrocarbons, chlorinated pesticides, polychlorinated biphenyls, metals, and butyltins. Tissue chemistry parameters measured in *M. nasuta* tissues included polynuclear aromatic hydrocarbons, polychlorinated biphenyls, chlorinated pesticides, metals, and butyltins.

The results of the above tests are discussed in Sections 3.3.2.2 and 4.4.2, and Appendix A.

4.4.2 Biological Testing Results

The dredged material evaluation process emphasizes potential biological effects caused by the chemical and biological interactions of the suite of contaminants present in the dredged material (see section 4.4.1). The results of the chemical and biological testing performed under the Oakland Harbor navigation improvement project are provided in Appendix A. Based on these results and the evaluation process, materials were categorized into various disposal options and potential uses (see section 2.4). Suitability determinations for aquatic disposal presented in section 2.4 applied the evaluation criteria of the Green Book (COE/EPA 1991) and PN93-2 along with best professional judgement that considered sediment chemistry data, all bioassay data, bioassay testing conditions (i.e., the presence of ammonia), and bioaccumulation data. The review of all data provided a weight-of-evidence assessment in the final suitability decisions made by participating regulatory agencies.

This section links the results provided in Appendix A and those provided in section 2.4 by summarizing the results of the dredged material evaluation using biological testing results (SPP, SP, and bioaccumulation) based on aquatic disposal requirements. Table 4.4.2-1 summarizes, by sample, calculable LC50s associated with the SSP tests, solid phase bioassay failures, and significant bioaccumulation of specific contaminants. It should be noted that the evaluation of the bioassay results (except the SPP test results) used the testing results from reference materials collected from the Alcatraz disposal site environs for in-Bay (B) determinations, and the testing results from a deep ocean reference site for ocean (O) determinations.

Suspended Solid Phase Tests

The results of the SPP testing revealed few toxic responses. None of the Outer Harbor Channel SPP or Inner Harbor Turning Basin SPP tests showed acute toxicity. Ammonia toxicity was responsible for the toxic responses noted in samples I-C1-B (intensive) and I-C1-B (Special). The only composite sample from the Inner Harbor that demonstrated significant toxicity was BC-4 (91.9 percent), which includes I-C9, I-C10, I-C11, and I-C12. Among samples collected from the berths, two samples (OB-2 and OB-3) demonstrated significant toxicity. A composite sample composed of all berth samples (IB-SPP) also showed a toxic response. The lowest LC50 measured (31.5 percent) was used in the STFATE model to determine LPC compliance at each aquatic disposal site.

Solid Phase Tests

Acute SP bioassay failures shown in Table 4.4.2-1 were determined using guidance provided in the Green Book (COE/EPA 1991) and PN93-2. Acute toxicity effects on *Rhepoxynius* (using mortality as the endpoint) that are statistically significantly lower and more than 20 percent below those observed in reference sediments determine materials unsuitable for unconfined aquatic disposal. For other test species, 10 percent is the significant effects threshold. Acute toxic responses (both ocean and in-Bay comparisons) were observed in 7 samples from the Inner Harbor; 11 samples from the Outer Harbor; 3 samples from the Inner Harbor Turning Basin; and 2 samples from the berths (see Table 4.4.2-1). In general, there were more failures measured in the worm species (*Nephtys*) than in the amphipod species (*Rhepoxynius*). No failures were observed in the fish bioassay, and only one toxic response was observed in the clam bioassay.

Bioaccumulation

The Green Book (COE/EPA 1991) does not specify numerical suitability criteria for assessing the biological significance of bioaccumulation data. There is guidance, however, for screening tissue concentrations deemed statistically significantly different from reference tissue concentrations against health standards set by the Food and Drug Administration for safe human consumption. The remaining Green Book guidance is descriptive, invoking best professional judgement to make bioaccumulation-based suitability decisions. Some considerations used in suitability determinations include: relative concentrations in tissues exposed to project sediments compared to in tissues exposed to reference sediments; whether one or both species bioaccumulated; how many chemicals bioaccumulated and to what magnitude over reference levels; and the seriousness of the health hazard posed by bioaccumulating chemicals.

Statistically significant bioaccumulation of PAHs, pesticides, PCBs, metals, and butyltins with respect to in-Bay and ocean reference sediments is shown for each test sample in Table 4.2.2-1. None of the statistically significant tissue concentrations in test organisms from samples collected in this project exceeded the FDA health standards. Tissue concentrations expressed as multiples of those found in the reference organisms are provided in Appendix A. Among contaminants, metals and PAHs appeared to bioaccumulate more frequently than pesticides, PCBs, and butyltins, suggesting metals and PAHs were generally present and bioavailable. Magnitudes of bioaccumulation were, in general, low for Outer Harbor samples and many Inner Harbor samples. Significant bioaccumulation was characterized in Inner Harbor Turning Basin and Berth samples by high magnitudes of many contaminants by more than one species. All Inner Harbor Turning Basin and Berth sediments were determined to be unsuitable for unconfined, open-water disposal.

4.4.3 Impact Significance Criteria

A biological impact is considered significant if it:

- Is expected to affect the population status of a state or federally listed, proposed, or candidate species or is expected to affect the breeding or foraging habitat of such a species resulting in increased mortality or reduced reproductive success.
- Causes the loss or long-term degradation of any environmentally sensitive habitat.

Table 4.4.2-1. Summary of Calculable LC50s, Bioassay Toxicity, and Significant Bioaccumulation based on Aquatic (Ocean - O, Bay = B) Disposal Requirements
(page 1 of 2)

Sediment Treatment	Calculable LC50s in Suspended Phase (%)			Solid Phase Toxicity (10-Day Tests)								Statistically Significant Bioaccumulation											
				Clam		Worm		Amphipod		Fish		LPAH		HPAH		Pest.		PCBs		Metals		Butyltins	
	Larval	Fish	Shrimp	O	B	O	B	O	B	O	B	O	B	O	B	O	B	O	B	O	B	O	B
Outer Harbor																							
O-C1						X	X	X	X			X	X							X	X		
O-C2									X			X								X	X		
O-C3												X	X							X	X		
O-C4-A																				X	X	X	
O-C4-B Intensive												X		X		X		X		X		X	
O-C5												X	X							X	X	X	
O-C6												X	X	X						X	X		
O-C7						X	X							X						X	X	X	
O-C8													X	X	X					X	X	X	
O-C9									X			X	X							X	X	X	
O-C10												X	X	X	X					X	X	X	
O-C11						X	X							X	X					X	X	X	
O-C12									X											X	X		
O-C13						X	X							X	X					X	X		
Inner Harbor																							
I-C1-A																X				X			
I-C1-B Intensive		49.0*						X*	X*											X			
I-C1-B Special	79.9*	76.4*				X*	X*	X*	X*					X		X				X		X	
I-C1-C								X	X					X		X				X			
I-C2								X	X			X								X	X		
I-C3												X								X	X		
I-C4																				X	X		
I-C5												X								X	X		
I-C7												X	X	X							X		
I-C8					X		X		X			X		X	X					X	X	X	
I-C9**	91.9								X			X		X	X					X	X		
I-C10**	91.9						X							X	X					X	X		
I-C11**	91.9						X							X						X	X	X	
I-C12**	91.9						X					X		X	X					X			
I-C14							X													X	X		
I-C15						X	X					X		X	X						X	X	X
I-C16						X	X					X	X							X	X		
I-C17						X	X		X					X	X					X	X		
I-C29												X	X	X	X					X	X	X	X
I-C30												X	X	X	X					X	X	X	X

Table 4.4.2-1. Summary of Calculable LC50s, Bioassay Toxicity, and Significant Bioaccumulation based on Aquatic (Ocean - O, Bay = B) Disposal Requirements
(page 2 of 2)

Sediment Treatment	Calculable LC50s in Suspended Phase (%)			Solid Phase Toxicity (10-Day Tests)								Statistically Significant Bioaccumulation											
				Clam		Worm		Amphipod		Fish		LPAH		HPAH		Pest.		PCBs		Metals		Butyltins	
	Larval	Fish	Shrimp	O	B	O	B	O	B	O	B	O	B	O	B	O	B	O	B	O	B	O	B
Inner Harbor Turning Basin																							
I-S1							X		X			X	X	X	X					X	X		
I-T1							X					X		X	X					X	X		
I-T3						X	X					X	X	X	X			X	X	X	X	X	X
I-T5														X	X					X	X	X	X
Berths																							
IB-1						X						X	X	X	X	X	X	X	X	X	X	X	
IB-2						X						X	X	X	X	X	X	X	X	X	X	X	X
IB-3												X	X	X	X	X	X	X	X			X	
OB-1												X		X	X		X	X			X	X	X
OB-2***	65.3		87.5									X		X	X	X	X	X	X	X	X	X	X
OB-3	31.5		65.1									X	X	X	X	X	X	X	X	X	X	X	X
IB-SPP (all berths)	58.4																						

- * Toxicity due to naturally occurring dissolved ammonia concentrations
 ** LC50 determined for composite BC-4 (I-C9, I-C10, I-C11, I-C2)
 *** Station BZ-34 Shoal (noted in section 2.4 and Appendix A) is represented by the results of OB-2.

- Interferes substantially with the movement of any resident or migratory fish or wildlife species.
- Causes a measurable change in species composition or abundance of a sensitive community or causes a substantial change to marine habitat within the harbor or disposal sites for a period of 5 years or longer.
- Adversely affects a plant species that is considered rare, threatened, or endangered, as indicated by its inclusion on California Native Plant Society List 1B or 2.
- Results in contaminated food webs.

4.4.4 Oakland Harbor

4.4.4.1 Project Impacts

Plankton Community

An increase in suspended solids in both Oakland Inner and Outer Harbors would result from the proposed dredging project both from the dredging operation and from barge overflow (overflow of material suitable for unconfined aquatic disposal for a maximum of 15 minutes at a time). The impacts would be characterized by increased suspended particulates, attenuation of light penetration, reduced dissolved oxygen concentrations, and possible release of metals and organics into the water column. As a result, potential impacts to the planktonic community associated with the increased turbidity may include a reduction in primary productivity of phytoplankton due to the reduced light in the water column, clogging of gills and feeding appendages of zooplankton, and possible toxic effects to the water column biota. Impaired feeding activities associated with clogged gills and feeding appendages could reduce the survival, growth, and biomass of zooplankton (EPA 1993a). However, the increased turbidity conditions are expected to be localized and temporary, lasting only while dredging activities persist. Therefore, reduced productivity and physical impacts resulting from the suspended sediments are not expected to be significant to the plankton community.

In order to assess potential toxic effects of metals and organics associated with suspended dredged material, suspended particulate phase (SPP) bioassay tests were conducted on Oakland Inner and Outer Harbor sediments. For most of the sediments tested, SPP results had lethal concentration (LC50) values ranging from 31 percent in one of the berth sediments to 100 percent. Simulation models for assessing whether suspended sediments would produce greater than one percent mortality to water column biota under various physical conditions occurring at a site were not available for the dredge site. However, LC50 values and associated limiting permissible concentration (LPC) values (LPC = 1 percent of the LC50) must be low in order for significant toxic effects to occur to organisms in the water column (i.e., less than 15 percent). Therefore, SPP results for the majority of the sediments indicate that the suspended sediments would not have a significant impact on water column biota. Potentially, contaminants occurring in Younger Bay Mud deposits of the Inner Harbor Turning Basin and berthing areas (slated for upland disposal) might cause toxicity, although the suspension of these sediments would be short term so that impacts are expected to be minimal. In addition, as discussed above in section 4.2.6.1, a considerable proportion of the contaminants suspended during dredging are bound to sediment particles

and either sink to the bottom or are not chemically bioavailable. This would further tend to reduce toxic effects on water column biota.

Impacts to the plankton community during dredging of sediments in the channel are expected to be insignificant. Potential toxic effects could occur from dredging some of the berth and Inner Harbor Turning Basin sediments. However, the suspension of these sediments is expected to be short term so that toxic effects would be minimal. Overall, impacts to the plankton community are not expected to be significant.

Benthic Community

Impacts to the existing benthic community of Oakland Harbor corresponding to the proposed navigation improvements (deepening, widening, enlarging various portions of the harbor) would initially be removal of the benthic community occurring in areas to be dredged. As a result, productivity would be reduced temporarily in the dredged regions. Recolonization of the dredged areas would occur by larval recruitment or immigration of organisms from nearby unaffected areas. Species first reestablishing the benthos would be small, near-surface dwelling opportunistic species. The Oakland Harbor navigation channel has and continues to be maintenance dredged periodically, resulting in a benthic community adapted to frequent disturbance. Other disturbances to the benthos occurring within harbor are prop-wash effects, commercial and human activities, and shoaling of channel bottoms (COE 1992a). Thus, the existing community is likely to be unstable, less developed, and less productive than nondredged regions. A similar community is expected to reestablish itself following navigation improvements. Greater impacts would be to communities existing in areas where widening will occur. The community that eventually develops would be less productive and more similar to that existing within the navigation channel. Recovery of the current benthic community in these areas would not be complete because they are subject to similar disturbances occurring in the channel (COE 1984). Because the existing benthic community is unstable and consists of species tolerant of disturbance, impacts of dredging in much of the project area are expected to be temporary and minimal.

Based on the results of the SPP toxicity tests described above (Plankton Community), toxic effects on benthic suspension and filter feeding infauna in areas adjacent to the dredge site, due to suspended dredged channel sediments, are expected to be insignificant. The potential exists for toxic effects to occur as a result of dredging Younger Bay Mud sediments of the berthing areas and Inner Harbor Turning Basin. Results of solid-phase acute toxicity tests conducted using various benthic invertebrates (clams, polychaetes, and amphipods) failed "Green Book" criteria for some of the channel, Inner Harbor Turning Basin, and berthing sediments. Thus, organisms present at these sites are likely to be tolerant of the levels of contaminants (e.g., PAHs, metals, organotins, and PCBs) found at the site. A large portion of the sediments that will be exposed upon completion of navigation improvements is expected to be "cleaner" than the surface sediments, since they were deposited more than 10,000 years ago. These sediments would not have been affected by human activity, and any toxic chemicals present would be naturally occurring components. Samples that were taken of these deep subsurface sediments indicated that concentrations of chemicals occurring in the sediments would not have a significant effect on benthic organisms that recolonize the dredge site.

Impacts to the benthic community existing in Oakland Harbor would be direct and consist primarily of removal of the community. However, because the community present at the dredge site consists of opportunistic species or those tolerant of disturbance, recolonization and reestablishment of a similar

community should be relatively rapid. In areas that had not previously been dredged (enlarging and widening regions), the benthic community would change to a less developed community similar to the channel assemblage. Toxic effects of newly exposed sediments and of suspended particulates are not expected to be significant. Therefore, the overall benthic community found within the harbor is not expected to be significantly impacted by the navigation improvements.

Fish Community

Fish occurring in the dredging areas would be disturbed by the increase in suspended solids that could affect the levels of dissolved oxygen in the water column, decrease visibility for foraging activities, and impaired oxygen exchange due to clogged or lacerated gills. Impacts would be greatest on fish eggs, larvae, and juveniles (COE 1992a). However, the turbid conditions are temporary and most fish will be able to avoid the area during dredging operations. Avoidance reactions in fish have been observed in studies of dredged material disposal impacts, in which fish migrated from the immediate vicinity of disposal operations, and returned within hours following disposal activities (O'Conner 1991; Sweeney 1978). It was concluded that the fish likely avoided the area primarily in response to noise and pressure waves produced by the disposal of the dredged material, although increased turbidity has had some role in the movement of the fish. A similar response may be expected at the dredge site as a result of disturbance and noise from the dredging activities. Turbidity in San Francisco Bay is characteristically high, so that many species occurring within the Bay are tolerant of turbid conditions and more likely able to tolerate the short-term increase in suspended sediments associated with dredging. Some fish, such as striped bass, are able to detect prey in highly turbid waters (COE 1992a; AHI 1991; O'Conner 1991). Additionally, lethal concentration levels of suspended sediments greatly exceed concentrations generally created during most dredging and disposal operations (COE 1988). Herring have spawned in intertidal areas (not included in dredging area) in the Inner Harbor area and along the Oakland-Alameda waterfront. The herring eggs could be negatively impacted by increased turbidity if dredging occurs during spawning season (December through February), or the fish may not spawn in the area as a result of the disturbance (COE 1992a; U.S. Navy 1990). However, the spawning area in the harbor is small relative to other spawning areas within San Francisco Bay (COE 1992a; U.S. Navy 1990). If dredging does not occur during spawning periods or if efforts are made to contain the suspended sediments, potentially significant effects on fish due to an increase in turbidity would be temporary and insignificant. Alternatively, dredging could be monitored by qualified fish biologists during the spawning season, and dredging could be redirected to another area if spawning is observed in the vicinity of dredging operations.

Another impact of concern would be the loss of prey species and altered benthic habitat as the sediments are removed. However, this impact is expected to be temporary, persisting until recolonization of the benthic community occurs. Due to frequent disturbances from previous dredging and other harbor activities, this habitat for fish is already diminished so that additional dredging should not have a significant impact on the fish or their habitat.

The potential impacts from toxic effects on fish as a result of dredging are expected to be minimal. As described in SPP tests for benthos, only dredging of the Younger Bay Muds might have any toxic effects on water column biota, such as fish. The presence of these sediments suspended in the water column will be limited to the immediate dredging area and fish will be able to avoid this area. As described above (Plankton Community), toxic effects of contaminants associated with the suspended sediments may be reduced since a large proportion sinks to the bottom or is not chemically bioavailable. The elevated turbid conditions are also expected to be short term and should not have a significant impact on the fish

species. Some of the sediments, especially in the berthing areas or Inner Harbor Turning Basin, failed "Green Book" criteria for acute toxicity tests on some of the benthic invertebrates which may be prey species of the fish. However, toxic effects were not observed in the fish species tested (juvenile sanddabs). Some bioaccumulation of metals (e.g., lead, cadmium, mercury, copper, silver), PAHs (e.g., naphthalene, fluorene), butyltins, pesticides, and PCBs were observed in clams (*Macoma* sp.) and worms (*Nephtys* sp.), which represent potential prey species. Thus, food-chain transfer of these contaminants may already occur with sediments existing at the site. Dredging would remove these layers and expose clean sediments that have not been affected by human activity. For a period, until more shoaling eventually occurs, sediment conditions at the site may actually improve. Therefore, toxic effects associated with dredging are not expected to be significant for the fish community.

In conclusion, impacts to the fish present at the site initially would include reduced prey availability, avoidance of the area due to increased turbid conditions, and possible effects on herring spawning activities or development. These conditions are expected to be temporary and minimal, particularly if dredging occurs during periods when herring do not spawn. Toxic effects associated with dredging are not expected to be significant. Thus, impacts on the fish community occurring in Oakland Harbor are expected to be insignificant.

Marine Mammals and Birds

Impacts to marine mammals and birds at the Oakland Harbor dredging site would result primarily from turbidity caused by the dredging operation, disturbance from operation of the dredging equipment, and effects on food resources such as fish and invertebrates. The effects of turbidity and disturbance by the dredging operation will be localized and temporary. Both turbidity and operations disturbance will cause birds and mammals to avoid, based on their mobility, the immediate dredging site during dredging operations. This should have a minor effect on foraging and other behavior of these animals, as the area to be avoided will be a very small part of the normal foraging, resting, or transit habitat for these species. There should be no significant reduction in short-term food availability for these species due to this temporary avoidance of the immediate dredging site. Once dredging in a specific area is complete, interference with bird and mammal activity in the area will end.

Resuspension of dredged material that is both suitable and unsuitable for unconfined aquatic disposal will occur at the immediate dredging site during dredging operations. As discussed in preceding sections, this will expose benthic invertebrates, plankton, and fish, which are fed upon by birds and mammals, to contaminants contained in these sediments. However, the exposure of these food species to contaminants will be temporary in any area and will be limited in areal extent. In addition, most fish, the principal food of marine birds and mammals, will also avoid the immediate dredging site, thus further reducing their exposure to contaminants. The expectation that birds and mammals will largely avoid the immediate dredging site, as discussed in the preceding paragraph, also reduces their exposure to potentially contaminated prey. Considering all of these factors, toxic effects or bioaccumulation resulting from exposure to contaminated suspended sediments and prey should be negligible for marine birds and mammals.

In the longer term, food for marine birds and mammals in dredged areas may be reduced until the benthic community in these areas becomes re-established. Food for bottom-feeding fish, which compose part of the food resource for birds and mammals, may also be reduced. These effects will be minor because they will be limited to the dredged areas, which make up a small part of the total foraging range of any birds

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or mammals. These effects will also be limited by the fact that much of the food-chain that includes marine birds and mammals is water-column based, and the water column environment is expected to return to normal soon after dredging ends.

In conclusion, impacts on marine birds and mammals at the Oakland Harbor dredging site are expected to be insignificant. Temporary avoidance of the dredging sites during dredging operations will have an insignificant effect on feeding and other aspects of the ecology of birds and mammals. Exposure of birds and mammals to sediment-borne contaminants will be small and temporary, so that toxicity or bioaccumulation of contaminants will be negligible.

Threatened, Endangered, and Sensitive Species

The endangered brown pelican and least tern have been observed to forage in Oakland Harbor. As described above for marine birds in general, brown pelicans and least terns are likely to avoid the immediate dredging area during dredging operations, with an insignificant effect on feeding success for these species. Least terns have been observed to forage primarily along the breakwaters and shallows of the southern shoreline of NAS Alameda and in Ballena Bay during May through August. In addition, exposure of the brown pelican and least tern to sediment-borne contaminants through feeding on potentially contaminated prey is expected to be negligible. The food supply for pelican and terns, which feed primarily on surface fish, is expected to return to normal soon after dredging ends.

The winter-run chinook salmon (federally threatened and state endangered) occurs occasionally in Oakland Harbor during migration season (November to May). Because the Harbor is not located within this species' main migration route, few individuals are expected to occur in the Harbor during dredging, and these would be likely to avoid the immediate dredging site where effects could occur. Therefore, potential effects (as described above for fish in general) on salmon such as turbidity effects, reduction in food resources, toxicity, or bioaccumulation, would be very limited in magnitude and duration. The resultant impacts on the winter-run chinook salmon would be negligible. The benthic community is expected to recover quickly enough following dredging that there should be no long-term effect on potential food sources for the salmon in the Harbor. The potential for impacts is further reduced because migrating adult chinook salmon have ceased to feed or almost ceased to feed by the time they enter the Bay on their upstream migration. Because there are no chinook spawning areas near or upstream of Oakland Harbor, juvenile salmon are not expected in the Harbor.

In conclusion, impacts on endangered, threatened, and sensitive species in Oakland Harbor are expected to be insignificant. Avoidance and limited use of the dredging site by such species during dredging operations will render negligible any short-term effects, such as those of turbidity, food reduction, or toxicity from or bioaccumulation of contaminants. Long-term effects, such as reduction in benthic- or pelagic-based food resources, are also expected to be negligible due to the fairly rapid recovery expected in these communities.

4.4.4.2 Mitigation Measures

The Corps will provide a qualified marine biologist observer on board the dredge plant during periods when dredging might have a greater effect on fish or wildlife, such as during herring spawning season from December through February to redirect the dredging operation away from and thus avoid effects on fish.

4.4.5 Disposal Site Options

4.4.5.1 Ocean Section 102

Dredged Material Testing Results

Solid phase acute toxicity test failures and significant bioaccumulation by test organisms which directly affect the suitability of material disposed at the Ocean Section 102 site are indicated in the Ocean (O) columns in Table 4.2.2-1. Significant acute toxic responses with respect to ocean reference sediment are relatively few (10 *Nephtys* and 3 *Rhepoxynius*). With respect to the ocean reference tissues, many test tissues bioaccumulated statistically significant levels of most contaminants; however, the magnitude of bioaccumulation was generally lower for Outer Harbor and most Inner Harbor tissues than for the Inner Harbor Turning Basin and Berth tissues.

Project Impacts

PLANKTON COMMUNITY. Dredge material disposal activity results in an increase in suspended particulates and a corresponding increase in turbidity within the water column. During disposal, potential effects of increased water column turbidity on planktonic organisms primarily include decreased phytoplankton primary productivity due to reduction of light penetration; entrapment and sinking of plankton due to ingestion by or adhesion of particles to the plankton; and decreased survival, growth rates, and body weight concentrations of zooplankton resulting from clogged and damaged feeding appendages (EPA 1993a; O'Connor 1991; Pequegnat et al. 1978). The extent to which these effects would occur depends upon the proportion of fine-grained sediments in the dredged material, which tend to remain suspended within the water column for longer periods of time than coarser material such as sand. However, the impacts for this project are expected to be minimal since the turbidity increase is localized and most of the disposed material settles to the bottom within minutes or a few hours (EPA 1993a). Because the bulk of the material settles rapidly, reductions in light attenuation and associated reduction in primary productivity would be slight and short term, continuing only until the dredge plume dissipates (EPA 1993a).

Toxic effects caused by contaminants associated with suspended sediments are not expected to occur as only sediments classified as suitable for unconfined aquatic disposal (based on acute toxicity and bioaccumulation tests) will be disposed at the ocean disposal site. A simulation model of dredged material disposal at the ocean site (STFATE model) was used to assess potential impacts of suspended particles within the water column (section 4.2). As described in section 4.2, the lowest LC50 (31.5 percent) obtained from SPP bioassay tests for Oakland Harbor sediments slated for aquatic disposal was used in the model. Therefore, the limiting permissible concentration of dissolved and suspended sediments within (after the first four hours of disposal) and around the disposal site at all times was 0.315 percent. Results indicated that disposal of the identified suitable Oakland Harbor sediments at the ocean disposal site, after four hours of mixing, would result in dredged material concentrations well below 0.315 percent (section 4.2). These results would comply with water quality standards and would not be significantly toxic to water column biota such as plankton.

Potential impacts to the plankton community, such as decreased productivity, growth, survival, and possible toxic effects as a result of increased turbidity, are expected to be minimal and only temporary since the dredge plume dissipates relatively quickly within hours or a few days. Results of toxicity tests

indicate that no toxic effects on planktonic biota should occur. Thus, impacts on planktonic organisms occurring within the ocean disposal area are expected to be insignificant.

BENTHIC COMMUNITY. Possible impacts on the benthos due to disposal of dredged material depends on the type and amount of material being deposited, the rate of accumulation and burial time, the frequency of disposal, and the type of organisms present at the disposal site. Suspension and surface deposit feeders would be most susceptible to burial. Mobile infaunal deposit feeders would be more likely to survive burial by their ability to burrow upward through the newly deposited material. Critical burial depths appear to range from 5 cm for suspension and surface deposit feeders to 30 cm for active burrowers, based on various studies on critical burial depths for different benthic organisms (Nichols et al. 1978; Maurer et al. 1978). Thicknesses exceeding 5 to 30 cm could result in significant mortality, particularly to surface deposit and suspension feeders. Therefore, the dominant species at the preferred disposal area, *Prionospio delta*, a surface deposit feeder, may be particularly susceptible to disposal. Slow-moving epifaunal invertebrates, such as the predominant species within the site, seastars, sea cucumbers, and brittlestars, also have a potential for burial and possible mortality. The thinner the disposal layers (e.g., less than 10 cm), the more likely these organisms will be to survive.

Dispersion modeling was performed for the impact of disposing 6 million cy of sand, silt, and clay over a period of one year at Alternate Site 5 (EPA 1993a). The results indicated that most of the dredged material footprint was less than 10 cm thick and that the part that would be thick enough to cause substantial burial and mortality is a relatively small central mound within the site. This mound would most likely consist of rapidly settling cohesive material and would persist throughout the use of the site. A mound of dredged material approximately 27 cm thick resulted when models representing a worst case scenario were run using 1.6 million cy of sediment disposed at one time (U.S. Navy 1993a). Monitoring results for the disposal of dredged material from Navy projects at Ocean Section 102 indicated that the pattern of deposition was similar to that modeled and that no dredged material reached the marine sanctuary. The maximum amount of suitable Oakland Harbor dredged material proposed for unconfined ocean disposal is a total of 5.4 mcy over a period of two years. Although dispersion modeling was not performed for this quantity of material and time frame, the dredged material footprint is expected to be comparable, or slightly less extensive and thinner than the modeled footprint for the 6 mcy disposal. A relatively small central mound would still be expected to occur within the site.

Overall, the Oakland Harbor dredged material to be disposed at the ocean site is sandier and has a lower total organic carbon concentration than the ambient material at the disposal site. With a change in substrate type and available organic food source, a change in the benthic community present may be expected to occur. The community that develops subsequent to disposal would more likely be represented by species that are adapted to disturbance and typical of coarser material. This may include species already present at the site which recolonize the area following disposal activities, and species introduced with the dredged material.

Recolonization after disposal of the dredged material generally occurs by vertical migrations of deposit feeding organisms through the deposited material and by larval recruitment or immigration of organisms from adjacent areas. Although studies of recolonization following deep ocean disposal are lacking, studies in shallower waters indicate that recolonization is rapid for establishing an opportunistic pioneering community (EPA 1993a). Species that are most likely to first recolonize by larval recruitment include small, near surface dwelling, opportunistic polychaetes, such as those in the Spionidae and Capitellidae families. Thus, although the predominant species in the area, *Prionospio delta*, is susceptible to the

deposition of dredged material, it is also more likely to rapidly recolonize the area. Other species recolonizing the site include species that are able to tolerate disturbance and changes to their environment.

Based on the dispersion models for disposal of dredged material at the ocean site and various burial and recolonization studies, impacts such as mortality of organisms resulting from burial and smothering by dredged material disposal are expected to be minimal in areas covered by less than 10 cm of dredged material, but somewhat greater in thicker deposits such as a central mound that may be formed at the release site. These effects are expected to be temporary, however, because recolonization is expected to be relatively rapid, as discussed above. The benthic community initially formed is expected to consist of opportunistic species and those that are more tolerant of disturbance. Because the total organic carbon concentration and grain size of the dredged material differs from the ambient sediment at the disposal site, the community that recolonizes the site may also be more representative of a sandier community. Even these effects, however, are expected to be temporary (a few months to a few years), as the disposed material becomes mixed with native material through natural deposition, slumping, resuspension, and other physical processes, and the benthic community responds accordingly. Overall, burial and other physical effects of disposal on the benthic community are expected to be localized, short-term, and not significant. However, impacts on the community where the central mound forms would persist for a longer period of time.

Based on the results of suspended particulate phase, solid-phase acute toxicity, and bioaccumulation tests, dredged material to be disposed at the ocean site is not expected to be toxic to benthic organisms living at the site. Material to be deposited at the site includes those sediments which passed toxicity tests by having mortalities in the test sediments less than 20 percent below reference sediments for amphipod tests, and less than 10 percent below the reference for other species tested: juvenile sanddab, clam, and polychaete worm. The results indicate that the dredged material should not have acute toxic effects on the survival of benthic organisms (e.g., small crustaceans, worms, bivalves, and fish) present at the disposal site. According to SPP test results, sediments to be disposed would not have toxic effects on water column biota, which is important for survival of larval or juvenile stages of benthic species occurring in the water column.

Sediments determined as suitable for ocean disposal also exhibited low amounts of accumulated contaminants in clam and worm tissues in bioaccumulation tests (low relative to reference tissues and less than FDA action limits). All sediments to be disposed of in the ocean met the "Green Book" acute toxicity and SPP test standards. In some of the bioaccumulation tests, both worms and clams accumulated some metals, PAHs, and tributyltins during the tests, although the levels were low and below FDA action limits. Chemicals accumulated included naphthalene, pyrene, fluoranthene, benzo(b)fluoranthene, monobutyltin, tributyltin, and various metals (lead, zinc, chromium, silver, copper, selenium, arsenic, and mercury). Most of the accumulated chemicals were low and only slightly elevated above the reference, and were not accumulated to harmful levels as evidenced by the results of the acute toxicity tests. Most of the contaminants found in the tissues were also of natural origin and are not expected to be a health risk.

In conclusion, no significant impacts to the benthic community of the ocean disposal site are expected. Long-term alteration of this community is not expected, although impacts may persist for several years at the release site where a central mound generally forms. There may be some burial and other physical effects, but this will be very localized and temporary. No significant toxicity or bioaccumulation of toxic chemicals is expected in the benthic community as a result of disposal.

FISH COMMUNITY. Potential impacts of dredged material disposal on fish resulting from increased suspended solids include impaired oxygen exchange due to clogging or laceration of gills, reduced food availability due to burial of benthic organisms, reduced visibility for foraging activities, and burial of slower moving bottom fish (O'Connor 1991; COE 1978). Initially, some of the species may be attracted to introduced prey such as invertebrates that were released from the dredged material (EPA 1993). However, the dominant reaction is expected to be avoidance of the disposal plume by fish, which are highly mobile, so that effects of turbidity are expected to be negligible. Many of the demersal species should also be able to avoid burial during the disposal, although they may be displaced from the area until the disposal area is recolonized by prey species (e.g., polychaete worms). The effects of this temporary displacement are expected to be minimal since the displaced fish will be able to feed in adjacent areas. Some of the more sedentary species present, such as eelpouts (Zoarcidae) may have more difficulty avoiding burial. However, fish densities and biomass are low at the site, and potential impacts are expected to be localized and minimal, and therefore not significant.

Suspended particulate phase and acute toxicity tests were performed on juvenile speckled sanddabs in order to evaluate possible toxic effects of dredged material disposal on fish both in the water column and on the bottom. Because only suitable material will be disposed at the site, toxic effects are not expected. Mean survival for the acute toxicity tests was greater than 90 percent in all but one test replicate for sediments determined to be suitable for ocean disposal (I-C8, IIIA = 85 percent; I-C8, IIIB = 97.5 percent). The SPP toxicity tests results and subsequent modeling indicate dredged material concentrations in the water column will be well below the LPC value of 0.315 percent, as discussed above for plankton. Therefore, no significant toxic effects from suspended particulates or dredged material on the bottom are expected for fish occurring at the disposal site.

Bioaccumulation of contaminants is not expected to be a problem at the site, since only suitable material for unconfined aquatic disposal will be placed at the site. Bioaccumulation tests were not performed on fish. Bioaccumulation tests that were performed on possible benthic prey species (worms and clams) showed bioaccumulation of PAHs and some metals at low levels that were not considered hazardous, as described above for the benthic community.

A potential impact of concern is the possible biomagnification of some of the contaminants in tissues of fish and other organisms feeding on the benthic species (clams, worms, demersal fish). For the most part, mercury is of greatest concern, for it has been shown to be transferred through the food chain, while often only a small proportion of other metals exhibited in the prey species may be passed on to the predatory organisms (Connell and Miller 1984). Hydrocarbons (e.g., the PAHs naphthalene, pyrene), may be transferred through the food chain, although certain compounds (alkanes) are less likely to biomagnify and may be metabolized by the organisms (Connell and Miller 1984). Certain benthic organisms such as copepods, nematodes, molluscs, crustaceans, polychaete worms, and bacteria are able to metabolize petroleum hydrocarbons and would thus degrade some of the PAHs present in the dredged material (U.S. Navy 1993a). In addition, fish are mobile predators, so that benthic organisms affected by disposal are expected to make up a small part of the diet of individual fish. This, in conjunction with the very low level of bioaccumulation of toxic chemicals expected within the benthic community, indicates that biomagnification of toxic chemicals in predatory species such as fish will be negligible.

In conclusion, impacts such as loss of food or habitat for fish are expected to be localized and temporary. Because the turbidity conditions are temporary, the disposal should not interfere with any possible migratory species, and any changes in the fish community are expected to be temporary. Based on the

results of the SPP toxicity and bioaccumulation evaluations, the ability of the fish to avoid the dredged plume, and the relatively low fish population at the disposal site, impacts of dredge material disposal on fish are expected to be minimal and insignificant.

MARINE MAMMALS AND MARINE BIRDS. Generally, impacts to marine mammals and birds in the vicinity of the disposal site would be localized and temporary. Possible impacts include reduced visibility for foraging activities, reductions in available prey, alteration of passage routes to avoid the turbidity and ship traffic, occurrence of ship-following behavior patterns in birds, and ingestion of contaminated prey items. Although reductions in water clarity due to increased turbidity during disposal may limit the foraging efficiency of both birds and mammals, significant reductions in clarity are generally concentrated at the release site, and are of short duration (hours to a few days). Availability of prey items, such as fish, krill, and other zooplankton, may be temporarily reduced in the disposal area, since these organisms likely would escape or avoid the disposal plume. Thus, foraging success within the immediate disposal area would be limited temporarily. However, the birds and mammals are capable of foraging in unaffected areas within the region and should not be significantly affected by any reduction in prey. Normal feeding activities and passage routes may be altered by the increased ship traffic during disposal activities as a result of birds following the barges and tugs, or mammals avoiding the noise created by the ships transiting to the site (EPA 1993a). However, these behavior alterations would be temporary, occurring predominantly during disposal activities.

Another possible impact of dredged material disposal may be ingestion of prey items that have been contaminated by the dredged material. However, since only material that is suitable for unconfined aquatic disposal will be disposed at the ocean site, this is unlikely. As described above, bioconcentration in fish species is expected to be minor. For the most part, birds and mammals will feed on pelagic fish species, which are only temporarily exposed to the dredged material. Bottom dwelling organisms occur in the diets of some marine mammals, such as the northern fur seal which feeds on crabs, squid, sablefish, anchovies, and rockfish (EPA 1993a; Ainley and Allen 1992). However, the disposal site is very deep and is likely to be a small part of the foraging range of any bird or mammal, so that the diet of a bird or mammal will be made up primarily of organisms that would not have been exposed to the dredged material. Therefore, biomagnification of contaminants is expected to be insignificant.

In conclusion, impacts such as loss of prey items, reduced foraging efficiency, alterations of passage routes, and changes in behavior patterns, are expected to be temporary and localized at the release site. The birds and mammals are able to avoid the dredge plume and forage in areas where fish may have escaped. Biomagnification of contaminants in birds and mammals is expected to be negligible. Therefore, impacts to marine mammals and birds will not be significant.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES. Threatened, endangered, or sensitive species which occur within or in the general vicinity of the ocean disposal site include gray, humpback, blue, finback, and sperm whales, Steller sea lions, northern fur seals, winter-run chinook salmon, peregrine falcons, brown pelicans, and short-tailed albatross. Potential impacts such as impaired visibility for foraging and reduced food availability within the area of disposal, which would alter normal feeding or passage activities, would be temporary and localized at the release site (EPA 1993a). The listed whales and pinnipeds forage throughout the region off the central California coast, so that any reduction in the food supply in the disposal area would be insignificant. Many of the whales, such as the humpback and gray whale, and the Steller sea lion generally occur over the continental shelf areas, so that few would be affected by disposal operations. Additionally, both whales and pinnipeds are highly mobile and

capable of avoiding the dredge plume. Any impacts upon endangered or threatened whale or pinniped species are expected to be minimal and insignificant.

Although California brown pelicans roost on the Farallon Islands, this species does not breed off central California. During calm weather, this species may be found over upper slope waters. However, the majority of the brown pelicans were sighted foraging over shallower shelf waters. Similarly, winter-run chinook is found primarily over the continental shelf. Because both species primarily forage in shallower waters away from the disposal site, these species are not expected to be affected by the disposal activities.

Similar to the California brown pelican, peregrine falcons roost at the Farallon Islands, which are approximately 25 nautical miles from the ocean disposal site. This species formerly bred on the Farallones but has not done so in the recent past. Peregrine falcons feed on small birds (e.g., storm-petrels and auklets) and have been observed foraging west of the islands, in the general direction of the ocean disposal site (PRBO 1991 as cited in U.S. Navy 1993a). Peregrine falcons potentially forage at the ocean disposal site; however, this species occurs throughout the offshore central California coast area and is not expected to be significantly affected by disposal operations. If variations in normal feeding patterns or passage activities associated with ship-following behavior patterns (as observed in other bird species) occur, these behavior changes would be temporary, generally continuing only during disposal operations.

The endangered short-tail albatross has been sighted over slope waters off Monterey Bay and Cordell Bank. However, the occurrence of this species is rare, and the albatross has not been sighted in the vicinity of the ocean disposal site. Therefore, no adverse effects on this species are expected to occur.

Bioaccumulation, as described above (Marine Mammals and Marine Birds section), is not expected to be a problem in the marine birds and mammals. Only suitable material will be disposed at the site, so that ingestion of contaminated prey is unlikely. Most of the endangered or threatened whale and pinniped species feed on pelagic species such as fish, which are only temporarily exposed to dredged material. The dredge site is likely to be a small part of the foraging range of the endangered species, so that the only a small proportion of bird's or mammal's diets will be made up of organisms that have been exposed to the dredged material. Therefore, biomagnification of contaminants is expected to be insignificant, and should not negatively impact any threatened, endangered, or sensitive species.

Impacts to threatened, endangered, or sensitive species caused by disposal activities are considered insignificant. Potential impacts are considered minimal, restricted primarily to the release site, and are temporary in nature. Therefore, no loss of foraging habitat, mortality, or reduced reproductive success is expected to occur for these species.

Mitigation Measures

Mitigation measures to reduce impacts to the biological community include accurate positioning to ensure that dredged material is confined within the disposal site boundaries so that adjacent communities are not affected. Measures will also include monitoring the disposal operations and potential effects on the existing pelagic and benthic communities according to the monitoring program specifically designed for the Ocean 102 Site and for this project. The monitoring program outlined in the EIS for the EPA 102 deep water ocean disposal site and a Site Management and Monitoring Plan for the ocean disposal site (EPA 1994) specify monitoring for both long and short-term (project-specific) impacts of dredged material

disposal. The project-specific monitoring program described in the EIS including disposal monitoring and surveillance will be implemented in this program. EPA anticipates finalizing the proposed SMMP in July 1994. Disposal monitoring will include the following:

- Daily records of dredging operations, transportation schedules, barge load volumes disposed, and exact location and time of disposal.
- Inspection of dredging operations by a qualified inspector who will submit a report describing operations.
- If a violation occurs, it must be reported to the EPA within 24 hours, and all modifications required to bring disposal operations into compliance must be made prior to continuation of disposal activities at the site.
- Monitoring of dredged material transport following disposal will occur in order to assess whether the material remains within the disposal zone or is transported out of the disposal site, and potentially into the Gulf of the Farallones Marine Sanctuary.

The surveillance and inspection of discharge operations may include the following:

- On-board inspection by EPA Region IX, the COE's San Francisco District staff, or a certified inspector to ensure that transportation and disposal of sediments occur within the designated discharge zone and that compliance with all permit terms and conditions is met.
- Accurate and precise navigation and positioning is required to ensure that disposal occurs within the designated site boundaries. A record of the barge navigation course while inside disposal boundaries throughout disposal operations will be maintained.

The Site Management and Monitoring Plan involves a tiered approach to addressing effects of dredged material on the biological community. The first tier of monitoring includes observations and sampling to identify if adverse impacts to the marine bird, mammal, or midwater-fish populations have occurred as a result of the surface and water column dredge plume, and to indicate if the dredged material footprint extends outside of the designated site boundary. If impacts have occurred to the birds, mammals, or fish populations, studies exploring the causes for the observed changes will occur in the second tier of testing. Tier 2 studies will also involve identifying if any impacts of dredged materials have occurred outside the designated disposal area on benthic community structure. If significant impacts have occurred to the biological communities, Tier 3 will involve various mitigation measures such as reducing the size or location of the disposal zone, moving the zone, revising permit conditions on placement, limiting the amounts of material disposed in a year, and various other options developed as the monitoring program progresses.

4.4.5.2 Alcatraz

Dredged Material Testing Results

Only dredged material suitable for unconfined Bay disposal pursuant to Clean Water Act criteria would be disposed at the Alcatraz site. Solid phase acute toxicity test failures and significant bioaccumulation by test organisms which directly affect the suitability of material disposed at the Alcatraz Disposal site are indicated in the Bay (B) columns in Table 4.2.2-1. Significant acute toxic responses with respect to Bay reference sediment, although more frequent than ocean reference comparisons, are relatively few (15 *Nephtys* and 10 *Rhepoxynius*). With respect to the Bay reference tissues, many tissues bioaccumulated statistically significant levels of most contaminants; however, the magnitude of bioaccumulation was generally lower for Outer Harbor and most Inner Harbor tissues than for the Inner Harbor Turning Basin and Berth tissue samples.

Project Impacts

PLANKTON COMMUNITY. Similar impacts to the plankton community described for the ocean site would be expected to occur at the Alcatraz disposal site. Impacts such as reduced primary productivity in phytoplankton and a decrease in growth, survival, and biomass of zooplankton are expected to be temporary and localized. Oakland Harbor sediments that have been identified as suitable for in-bay disposal, based on sediment chemistry, SPP, solid-phase acute toxicity, and bioaccumulation tests, have an approximate combined percentage of fine-grained material of 56 percent (or 44 percent sands). The majority of the material, in particular coarser grained material, is expected to settle rapidly, within minutes to hours. Because the Alcatraz site is located in a highly dynamic region of the bay, some of the finer material may remain in suspension and be carried to other regions in the bay, or out of the bay. This could affect planktonic organisms at the site and other regions in the general vicinity of the site. However, the increased turbidity conditions are expected to be short term and should not significantly impact the plankton community.

In addition to turbidity associated with the disposal event, studies conducted at the Alcatraz disposal site indicated that suspended solids concentrations increased at the Alcatraz site particularly when maximum current conditions occurred during flood and ebb tides (AHI 1991). AHI postulated that the increased turbidity may be associated with resuspension of eroded material off the disposal mound. Thus, increased turbid conditions during tidal events would continue as long as disposal occurs at the site and as long as the mound persists. However, disposal of additional material at the disposal site is not expected to increase the suspended particulates to an extent which would significantly impact the planktonic community, although it would extend the length of time for which periodically increased turbid conditions would persist.

As indicated above, only sediments that were identified as suitable for in-Bay disposal would be deposited at the Alcatraz site. Therefore, toxic effects related to contaminants in the sediment are not expected to occur. Although a specific simulation model was not conducted for the conditions existing at the Alcatraz site, results of SPP tests for sediments to be deposited in-bay indicated that these sediments would not have significant toxic effects on water column biota. Under most conditions, the LC50 value determined for the SPP tests would have to be quite low in order to result in toxic effects on the biota.

Impacts to the plankton community are expected to be minimal and temporary, lasting until the dredge plume dissipates within hours to a few days. According to toxicity tests, no toxic effects on planktonic organisms should occur. Therefore, impacts on the plankton community at and in the vicinity of the Alcatraz disposal site are expected to be insignificant.

BENTHIC COMMUNITY. As a result of past continuous disposal of dredged material at the Alcatraz site, the benthic community that has developed is variable in composition and abundance and is characterized by opportunistic species that are tolerant of disturbance (COE 1988, 1992a; Segar 1988). Because the community at the site has continually changed with each disposal activity, impacts on the benthic community as a result of burial are not expected to be significant. The presence of opportunistic species at the site and in the surrounding area would allow for rapid recolonization of the site. Species present at the site prior to disposal may also burrow through the deposited dredged material, particularly in deposits of less than 10 cm, although some invertebrates may survive in up to 30 cm of burial (EPA 1993a). Some of the finer-grained material may settle in areas other than at the release site, although deposits would be relatively thin, and should not significantly impact the community existing at these areas. Epibenthic organisms such as the Dungeness crab, migrating through the site in late winter/early spring, could be affected (smothered or displaced) by the disposal, although the crabs should be able to avoid the site during disposal activities. Disposal should occur during periods in which the crab is not migrating through the area.

Sediment SPP, solid-phase acute toxicity, and bioaccumulation tests were performed on the Oakland Harbor sediments in order to assess the possible toxic effects that may result from disposal of the Oakland material at in-Bay disposal sites. As discussed for plankton, results of SPP tests indicated that suspended particulates would not cause toxic effects to organisms occurring in the water column or feeding off of the suspended particulates (various benthic suspension or filter feeders). Sediments that were determined to be suitable for in-Bay disposal met with PN 93-2 and "Green Book" standards for solid-phase acute toxicity tests. Bioaccumulation of some contaminants such as various metals, PAHs, and tributyltin was observed in the clams and worms tested; however, levels were low and, as verified in the acute toxicity tests, would not be toxic to the organisms present at the site.

Because the benthic community existing at the site is unstable and characteristic of a frequently disturbed community, impacts associated with burial and smothering of the benthos are expected to be minimal, localized, and temporary. Based on various toxicity and bioaccumulation tests, and the suitability determinations for sediments slated to be deposited at the site, significant toxic effects are not expected to occur. Therefore, impacts to the benthic community present at the Alcatraz site are expected to be insignificant.

FISH COMMUNITY. Disposal effects on the fish community existing at the site are generally associated with an increase in suspended solids at the site, including impaired gas exchange as a result of clogged gills, impaired visibility, and a reduction in prey species at the site. These direct effects associated with disposal operations are expected to be minimal since the dredge plume dissipates rapidly, so that reduced water clarity and physical obstructions caused by turbidity should be of short duration. As discussed above (in Plankton Community), there is some concern that an additional increase in suspended solids concentrations at the Alcatraz site may occur as a result of the resuspension of eroded material off the disposal mound. However, fish are able to avoid or in some cases tolerate an increase in suspended solids concentrations, so that impacts are expected to be negligible. Fish migrating through the area, such as striped bass and winter-run chinook salmon, should be able to avoid the increased turbidity at the site.

Impacts – Biological Resources

Studies of white perch and striped bass eggs and larvae indicated that these stages of development are rather tolerant of suspended particulates (COE 1992a, AHI 1991).

Another concern is that the mound may spread and cover the surrounding sandy environs which represent a suitable habitat for flatfish. However, the results of bathymetric surveys conducted by the Corps, and grain-size analyses conducted on Alcatraz environs samples (see Appendix A, RAM sample results) indicate that the sediments surrounding the mound have remained sandy despite the considerable amount of material that has been disposed of at the site in recent years.

Toxic effects associated with dissolved and suspended solids are also not expected, based on results of the SPP toxicity test. Acute toxicity test performed on prey species and flatfish juveniles (sanddabs) suggested that no acute toxic effects on fish would occur as a result of dredged material disposal (fish bioassays: 86 percent to 100 percent survival; survival less than 10 percent below survival in the dilution water). Bioaccumulation of some metals and PAHs occurred in prey species evaluated for bioaccumulation effects, although the levels were low and below FDA action limits. Biomagnification of these contaminants is not expected to be significant in the fish, since these species are mobile and feed in areas other than the Alcatraz site. In addition, certain chemicals such as chromium, lead, and zinc are not expected to biomagnify in higher trophic level species (COE 1992a).

In conclusion, both physical impacts as a result of increased suspended solids during disposal operations and toxic effects associated with bioaccumulation and biomagnification of contaminants within tissues are expected to be insignificant. Impacts to the fish community occurring at the Alcatraz site are expected to be short-term and minimal.

MARINE MAMMALS AND MARINE BIRDS. Generally, impacts to marine mammals and birds in the vicinity of the Alcatraz disposal site would be localized and temporary. Possible impacts include reduced visibility for foraging activities, reductions in available prey, alteration of passage routes to avoid the turbidity and ship traffic, occurrence of ship-following behavior patterns in birds, and ingestion of contaminated prey items. Although reductions in water clarity due to increased turbidity during disposal may limit the foraging efficiency of both birds and mammals, significant reductions in clarity are generally concentrated at the release site and are of short duration (hours to a few days). Availability of prey, such as fish and zooplankton, may be temporarily reduced in the disposal area since these organisms would likely escape or avoid the disposal plume. Thus, foraging success within the immediate disposal area would be limited temporarily. However, the birds and mammals are capable of foraging in unaffected areas within the region and should not be significantly affected by any reduction in prey. Normal feeding activities and passage routes may be altered by the increased ship traffic during disposal activities as a result of birds following the barges and tugs or mammals avoiding the noise created by the ships transiting to the site (EPA 1993a). However, because this disposal site is identified as a multi-user site and can receive up to 4.0 mcy per year based on existing guidelines, and disposal of the Oakland project sediments would occur within the established monthly and yearly volume limits, these impacts would not be significant.

Another possible impact of dredged material disposal may be ingestion of prey items that have been contaminated by the dredged material. However, since only material suitable for unconfined Bay disposal will be disposed at this site, this is unlikely. As described above, bioconcentration in fish species is expected to be minor. For the most part, birds and mammals will feed on pelagic fish species, which are only temporarily exposed to the dredged material. Bottom dwelling organisms occur as minor

components of the diets of the marine mammals present at the site (harbor seal and California sea lion). However, the disposal site is likely to be a small part of the foraging range of any bird or mammal, so that the diet of a bird or mammal will be made up primarily of organisms that would not have been exposed to the dredged material. Therefore, biomagnification of contaminants is expected to be insignificant.

In conclusion, impacts such as loss of prey items, reduced foraging efficiency, alterations of passage routes, and changes in behavior patterns are expected to be temporary and localized at the frequently used release site. The birds and mammals would be able to avoid the dredge plume and forage in areas where fish may have escaped. Biomagnification of contaminants in birds and mammals is expected to be negligible. Therefore, impacts to marine mammals and birds will not be significant.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES. Endangered birds that occur in the vicinity of the Alcatraz disposal site are the California brown pelican and the American peregrine falcon. Peregrine falcons have been observed to nest on the San Francisco-Oakland Bay Bridge in recent years, and it is possible that these falcons could forage for their prey (other birds) in the vicinity of the Alcatraz site; any use of the site by the falcon is likely to be minimal. California least terns do not nest or feed in the vicinity of the Alcatraz site.

Potential impacts to the pelican and falcon would be similar to those described above for marine birds in general: reduced visibility for foraging activities, reductions in available prey, alteration in foraging or passage areas/routes, and ingestion of contaminated prey items. Pelicans and falcons would be likely to avoid the disposal operation and so avoid any related impacts. Since the site is likely to be a very small part of the foraging range of individuals of either species, this would have a negligible effect on feeding or other aspects of the ecology of these species. For these same reasons, the pelican and falcon are expected to have minimal exposure to sediment contaminants or contaminated prey during disposal. In addition, since only suitable material would be disposed of at this site, minimal contaminants will be introduced into the site environment, so that the potential for bioaccumulation of contaminants up the food chain and related toxic effects on predators, such as the pelican and peregrine falcon, would be very small. Considering the above factors, the overall impact of disposal at the Alcatraz site on the California brown pelican and American peregrine falcon is expected to be insignificant.

Winter-run chinook salmon pass in the general vicinity of the Alcatraz site during their upstream migration (November to May), and outmigrating juvenile salmon also pass through the area from November through May (juveniles are approximately one year old at this time). Potential impacts to both adult and juvenile chinook salmon include disruption of migration patterns, suspended solids effects such as gill clogging, reduction in food availability, and toxic effects from direct exposure to sediment contaminants or through contaminated prey (bioaccumulation). The migration success of both adult and juvenile chinook salmon should not be affected significantly because both have the ability to detect and avoid the disposal plume, and to re-establish the migration course after any deviation. Passage of juvenile salmon out through the Bay is rapid (approximately one week), so that they are expected to take the most direct route to the ocean (WESCO 1988), which lies largely to the north of the Alcatraz site. Adult salmon are known to be most abundant in the Angel Island and Tiburon areas, and less abundant in the Alcatraz area (COE 1992a). These factors reduce the potential for disposal at the site to affect migration of the salmon. Salmon that are exposed to the disposal plume are unlikely to be affected significantly, as described in the following paragraphs.

For any adult or juvenile chinook salmon exposed to the disposal plume, effects of increased suspended solids (primarily impaired oxygen exchange due to gill clogging) are expected to be minimal. First, such exposure is likely to be of short duration, because the fish will tend to detect and avoid the plume, and because increased suspended solids in the water column at this site will be of short duration (10-15 minutes) for each barge disposal episode. In addition, significant gill clogging has been observed to occur when total suspended solids (TSS) levels reach several hundred mg/l, and TSS levels this high are not expected for disposal at the Alcatraz site (COE 1992a). At the regional level, disposal at the Alcatraz site will contribute minimally to suspended solids load in San Francisco Bay, as described in section 4.3.2 above, and in COE 1992a.

Reduction in food availability for migrating adult or juvenile salmon is expected to be negligible. By the time they enter the Bay, migrating adult salmon have either ceased feeding or are feeding very little. In addition, their avoidance of the disposal site will have little effect on their potential foraging habitat and food availability. The forage fish (primarily anchovies) on which they might be feeding would be expected to avoid the disposal site during a disposal event, and then return to the site within minutes or hours. Juvenile salmon feed on zooplankton and benthic invertebrates during the outmigration. For the reasons discussed in the preceding paragraphs, juvenile salmon are expected to avoid the disposal plume. For juveniles that do not avoid the plume, feeding may be reduced due to poor visibility or reduced prey abundance. Whether the juvenile salmon avoid the site during disposal or experience reduced food abundance at the site, the effect will be temporary (limited to the disposal event and immediately thereafter) and of limited areal extent, so that there should be no significant effect on overall food availability or feeding success for the chinook salmon.

Since only material suitable for unconfined Bay disposal will be disposed of at this site, there should be negligible exposure of chinook salmon to toxic contaminants either through direct exposure to suspended sediments or through prey consumption. SPP bioassays for this material showed negligible direct toxicity to fish. Although bioaccumulation tests showed minor uptake of some chemicals (some metals and PAHs) in clams and worms, this was at very low levels that were not expected to have adverse effects on predators of similar species at the disposal sites, as discussed above for the benthic and fish communities. In addition, the expected minimal feeding by salmon at the disposal site will further reduce the potential exposure of salmon to contaminants and any of the adverse effects thereof.

In conclusion, there should be negligible effects on adult and juvenile winter-run chinook salmon from exposure to toxic contaminants. Likewise, effects such as disruption of migration, reduced food availability, and turbidity effects, are also expected to be minimal. Therefore, disposal at the Alcatraz site is expected to have no effect on the continued existence of the winter-run chinook salmon.

Mitigation Measures

Significant impacts to the biological community existing at the Alcatraz site are not expected. Therefore, no mitigation is required.

4.4.5.3 Bay Farm Borrow Area

Dredged Material Testing Results

Solid phase acute toxicity test failures and significant bioaccumulation by test organisms which directly affect the suitability of material disposed at the Bay Farm Borrow Area are indicated in the Bay (B) columns in Table 4.2.2-1. Applicable test results are the same as those presented in section 4.4.5.2.

Project Impacts

PLANKTON COMMUNITY. As described in section 4.4.5.1, dredged material disposal and subsequent increase in suspended solids at the BFBA site potentially could result in such impacts as reduced primary productivity, clogged or damaged feeding appendages, toxic effects, and decreased survival, growth, and biomass. The suspended solids increase is expected to be localized and short term, since the bulk of the sediment generally would settle to the bottom within minutes or a few hours of disposal.

Toxic effects associated with contaminants in suspended sediments are not expected to occur for either disposal of the unsuitable material to be confined within the borrow pit, or the suitable sediments to be used for capping the unsuitable ("suitable" and "unsuitable," as used in this discussion, refer to suitability or unsuitability for unconfined aquatic disposal). The results of SPP bioassay tests on Oakland Harbor sediments considered for aquatic disposal were used in the STFATE model to assess potential impacts of suspended particles at the BFBA site. Worst-case combinations were run using SPP test results for the most contaminated material to be disposed at the site (LC50 = 31.5 percent, LPC = 0.315 percent, 98 percent fines, 2 percent sands), highest observed current velocities at the borrow area, disposal near the northern boundary during maximum ebb tide, and disposal near the southern boundary on a maximum flood tide, as well as many other disposal combinations. According to the various simulations run, water quality requirements would not be exceeded (concentrations of suspended material in the water column were less than 0.315 percent) for most sediments and current velocities tested, provided material is disposed within the pit at least 400 feet from the edge of the pit. One exception was disposal of sediments with an LC50 value of 31.5 percent in the lower southeast corner of the deep pit area, which violated water quality standards when current velocities were greater than 1.15 feet per second. Therefore no toxic effects on planktonic organisms are expected for Oakland Harbor sediments (LC50 $\geq$ 31.5 percent) disposed at the BFBA, provided that disposal occurs when current velocities are less than 1.15 feet per second or that provided material is not disposed in the southeast corner of the pit.

Impacts on water column biota occurring at and in the vicinity of the BFBA are expected to be insignificant. Toxicity test results indicate that no toxic effects on plankton should occur during disposal of both unsuitable and suitable capping material, provided conditions as described above are met. Impacts associated with increased turbidity such as decreased productivity and survival are expected to be minimal and temporary, persisting until the dredge plume dissipates (hours to a few days).

BENTHIC COMMUNITY. Impacts to the benthic community at the BFBA, particularly within the borrow pit where disposal of unsuitable material and capping sediments would occur, include burial and smothering of the organisms present at the site. Since approximately 3.3 feet of unsuitable material and 7.8 feet of cap material are planned to be placed within the borrow pit (or just 7.8 feet of suitable material under some scenarios), the benthic infauna present within the borrow pit are not expected to

survive. Some of the more mobile benthic species such as crabs may be able to escape from the site during disposal operations.

The rate of recolonization of the site will depend on the amount of material disposed, the time between each disposal event and final cap placement, the type of dredged material disposed (Oakland Harbor sediments identified as unsuitable ranged from 3 percent to 98 percent fines), and the level of contamination. (The effect of exposed unsuitable material placed at the site on the benthic community is addressed below). Once the initial cap (suitable) material is placed, initial recolonization would consist of surface dwelling opportunistic species and those more tolerant of stress. Species present may include organisms from the dredge site transported in the dredged material, or those common within the borrow area and surrounding environs. If material is placed episodically over a period of time, as is expected, the community is unlikely to progress beyond these initial opportunists until cap placement is complete. At this point, a more permanent community will begin to develop. Since the cap material will be coarser (sandier) than the existing fine sediments of the pit, the permanent community that develops will probably be a mixture of species currently occupying the site (as described in section 3.4.3.3) and species typical of the sandier areas adjacent to the pit. Dominant species found in the surrounding areas such as the mussel *Musculista senhousia*, the amphipod *Ampelisca abdita*, and the clam *Gemma gemma* should eventually colonize the cap area. Potentially, some of the dredged material may settle within the areas surrounding the borrow pit, although this layer should be relatively thin and recovery should be rapid, so that a significant impact on the communities in the vicinity of the disposal target is not expected to occur. This conclusion would also apply if only suitable material were disposed of at the site.

Suspended particle phase, solid-phase acute toxicity, and bioaccumulation tests performed on Oakland Harbor sediments were used for identification of suitable sediments for in-Bay disposal, which would be used for cap placement. As described for plankton, SPP tests imply that dissolved and suspended contaminants would not have a toxic effect on organisms, such as surface dwelling epifauna and infauna. Acute toxicity tests performed on burrowing detrital-feeding amphipods, detrital-feeding clams, deposit-feeding polychaete worms, and bottom-dwelling flatfish (sanddabs) had results for suitable sediments which did not exceed both "Green Book" and PN 93-2 guidelines for in-Bay disposal. Therefore, no acute toxic effects are expected on benthic organisms present on the cap layer. Bioaccumulation tests performed on these sediments resulted in tissue concentrations, in the worms and clams tested, that were below FDA action limits and well below reference concentrations. Contaminants that were accumulated in the clams and worms had low concentration levels (less than two to three times the reference concentration) of mercury, chromium, copper, lead, silver, nickel, arsenic, selenium, naphthalene, benzo(a)anthracene, fluorene, pyrene, and chrysene. In addition, because acute toxicity tests indicated no toxic effects, the levels observed in bioaccumulation tests are not expected to be harmful to the benthic organisms. Impacts would be the same if only suitable material were placed at the site.

Although no significant toxic effects on the benthic infauna are expected from the cap materials, the material determined to be unsuitable for unconfined aquatic disposal has a potential for adverse effects, depending on how long this material remains exposed. Some of the sediments identified as unsuitable failed acute toxicity tests, indicating that toxic effects such as mortality or abnormal development may occur for species attempting to recolonize the site subsequent to disposal. Other sediments exhibited no toxic effects, but had a large number of chemicals bioaccumulating, had relatively high levels of a contaminant in the test organisms (e.g., PAHs, PCBs, organotins, or various metals), or exceeded the FDA action limits. Thus, depending on which sediments are identified for disposal at the BFBA, toxic effects or significant bioaccumulation could occur in organisms recolonizing the site.

However, the design of disposal at the BFBA calls for disposing the unsuitable material in cells (smaller subsections of the borrow pit). The unsuitable material will be continually disposed within the cell for up to a period of a month, after which it will be immediately capped with a layer of suitable material approximately 30-50 cm thick. Other cells will then be filled in the same manner until all are filled or the dredging project is complete (up to two years of operations). Thus, the initial cell caps may remain exposed, relatively undisturbed (depending on the proximity of cells being filled), and available for recolonization for a period of up to two years. Once all the cells are filled, a final thick cap will be placed over all of the cells. During the period in which unsuitable material is disposed in a particular cell, no recolonization is expected to occur as the area will be continually disturbed by the disposal operations. Thus, an infaunal community that would be directly exposed and potentially bioaccumulating the contaminated material would not develop. An opportunistic community (colonized by species found in the areas surrounding the borrow pit) may develop on the initial cap layer within weeks to months (depending on the level of disturbance caused by disposal operations in adjacent cells). Some of these may be available as a food source to various epibenthic organisms and small fish. If the cell remains undisturbed for up to two years, some deeper dwelling organisms may be established at the site, which could potentially burrow down to the unsuitable material. However, this is not likely, as deep-burrowing species were not part of the benthic community inhabiting the pit documented by investigations of the BFBA prior to disposal. If despite the low probability of their occurrence, large deep-burrowing infauna did establish themselves on the cap within two years, it is expected that the availability of these organisms as a food source for fish typically found at the BFBA would be low. Additionally, the level of bioturbation and intrusion of unsuitable material into the cap layer during this period is not expected to be high enough to be significantly bioavailable to the benthic infauna or predators of these organisms. Once the final cap layer is placed, the layer should be thick enough (approximately 8 feet) to isolate the unsuitable material from the community that eventually recolonizes the site, so that bioaccumulation of contaminants is not expected to occur.

As indicated above (Plankton Community), no toxic effects to the benthic community are expected from suspended particulates associated with disposal of the unsuitable material, provided that disposal of unsuitable material occurs under appropriate current velocities and conditions.

In conclusion, significant impacts to the community existing within the borrow pit are not expected to occur over the short term (up to two years) while the unsuitable material is being placed and initially capped. Once the cap is in place, the area will likely recolonize rapidly, with a benthic community developing that is more similar to the ambient communities in the vicinity of the borrow area, so that long-term impacts to the benthic environment would be insignificant.

FISH COMMUNITY. Potential impacts of dredged material disposal on fish are described in section 4.4.5.1. Most of the fish species at the BFBA site should be able to avoid the dredge plume so that physical effects such as burial, clogged gills, and impaired oxygen exchange are expected to be negligible. Demersal species present such as various flatfish, gobies, and sculpin may be displaced temporarily until the benthic infaunal prey species recolonize the site. Some mortality may occur as a result of burial during disposal, although mortality should be minimal due to the mobility of the organisms. Most of the species found within the borrow pit were also observed in the regions surrounding the pit, so that loss of the borrow pit habitat is not expected to be significant to the fish community occurring in the vicinity of the disposal site. Because white croaker, anchovy, English sole, halibut, and goby juveniles were relatively abundant at the site during trawl surveys conducted during May, disposal during this time period may have a greater impact than in other seasons. Additionally, an eelgrass community is located

southeast of the borrow area. Dispersion models were conducted using various current velocities and worst-case disposal conditions to determine whether increased turbidity at the BFBA could temporarily reduce light penetration for photosynthesis in the eelgrass community and potentially affect eggs or spawning activities of fish such as herring, which may spawn in the grasses. These included high current velocities, disposal of material with an LC50 value of 31.5 percent, and disposal of material containing 98 percent fines at a location near the proposed containment dike, which was in closest proximity to the eelgrass beds (Figure 4.4.5.3-1). Results of the models using worst-case combinations indicate that spreading of dredged material would occur past the containment dike in the direction of the eelgrass beds. Overall retention rates of Oakland Harbor sediments disposed at the BFBA under varying current velocities were determined to be between 90 and 98 percent when depths are greater than 20 feet (depths will remain greater than 20 feet in the current disposal alternatives). However, the concentration of material that would reach the eelgrass beds was small (0.001 percent dredged material) and is not expected to have a significant impact on the eelgrass community. As indicated by SPP test results, toxic effects due to suspended particulates are expected to be negligible during disposal of both unsuitable and suitable cap material at the BFBA site, provided that disposal of the unsuitable material occurs under suitable conditions as described for the plankton community (i.e., when current velocities are less than 1.15 feet per second or disposal does not occur in the southwest of the pit. Similarly, once the cap is in place, toxic effects due to dredged material are expected to be minimal since only material suitable for unconfined aquatic disposal (based on acute toxicity and bioaccumulation tests on fish) will be used for the cap. Some contaminants were bioaccumulated in potential prey species (clams and worms), although the levels were low. As described in section 4.4.5.1, fish likely do not restrict their foraging to the BFBA, so that biomagnification of these chemicals within fish tissues is not expected to occur.

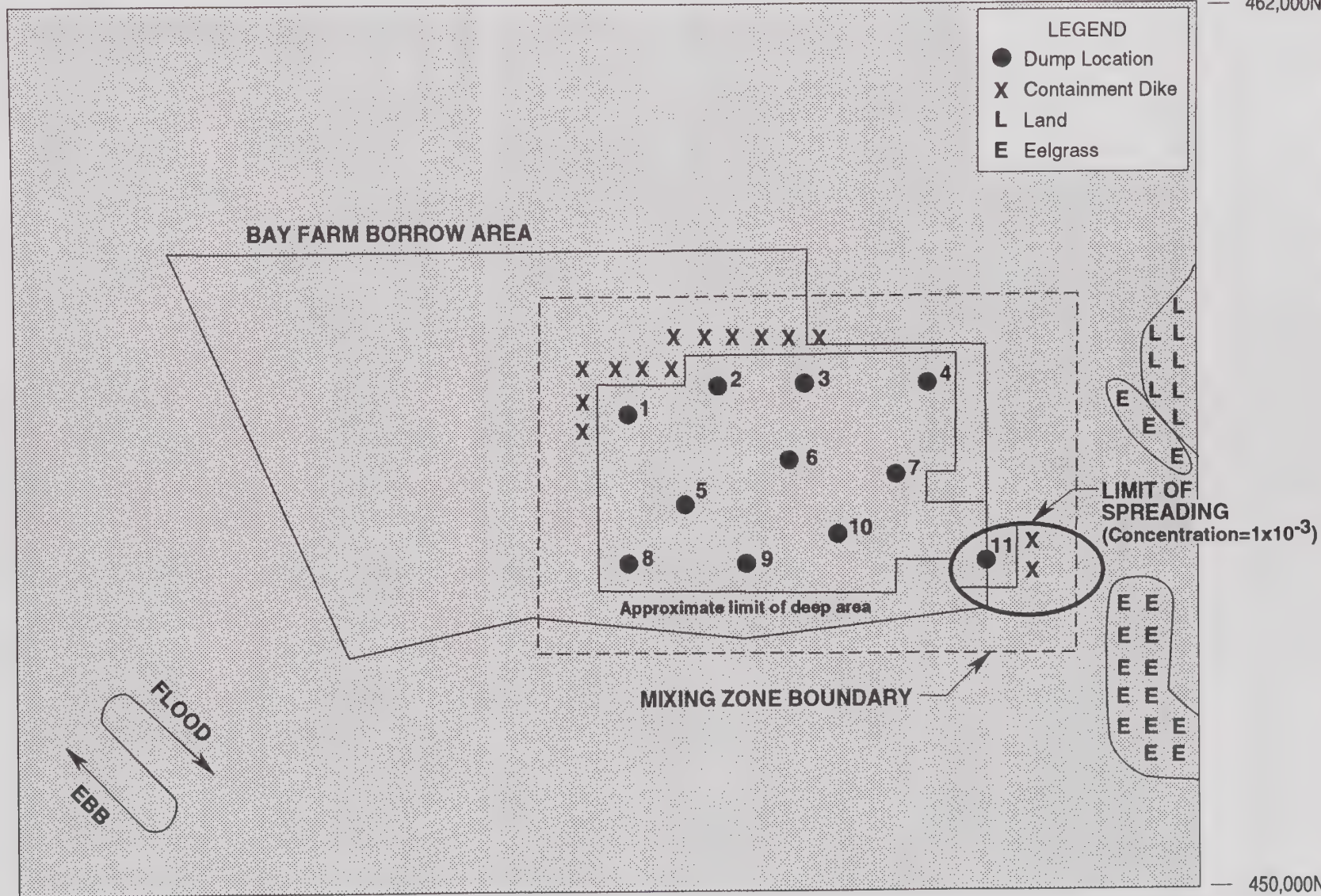
As indicated above (Benthic Community), since unsuitable material is expected to be immediately capped with a layer of suitable material for each cell following disposal over a period of one month, possible toxic effects should not occur in demersal fish species, nor is biomagnification of the contaminants in fish tissues as a result of consuming contaminated prey expected to occur. Acute toxicity tests, using juvenile sanddabs, performed on unsuitable channel sediments that may be disposed at the site, resulted in mean survival percentages greater than 86 percent, which were not more than 10 percent below, or statistically different from the reference sediments. Thus, direct mortality of flatfish and other fish exposed to the unsuitable material is expected to be minor. Additionally, since these species are mobile and since the cell will be continually disturbed as unsuitable material is disposed, they would likely avoid the area and consequently not be exposed to any contaminants present. As described in Benthic Community, bioaccumulation of contaminants is not expected to occur within the fish species found at the BFBA, since a benthic community is not expected to be established and available as a food source during disposal of the unsuitable material, and since most of organisms which would recolonize the area following the initial capping would not be exposed to the unsuitable material. If deep burrowing organisms, which could be exposed to the unsuitable material, did establish themselves (which is unlikely based on the community currently existing at the site), the availability of these organisms as a food source for fish found at the BFBA would be low. Therefore toxic effects on fish by dredged material disposal at the BFBA is not expected to be significant.

Impacts to the fish and nearby eelgrass communities such as bioaccumulation of contaminants and various sublethal effects, particularly in smaller fish and juveniles, is not expected to be significant if the unsuitable material is immediately capped following continual disposal over a period of a month, as called for in the design of disposal at the BFBA. Physical and toxic effects as a result of increased suspended

1,476,000 E

1,492,000 E

462,000N



450,000N

Figure 4.4.5.3-1

DISPERSION OF DISPOSED DREDGED MATERIAL IN RELATION TO EELGRASS BEDS, BAY FARM BORROW AREA

Impacts – Biological Resources

sediments are expected to be localized and minimal. Once the cap is in place and contaminants contained, recolonization of prey species is expected to be relatively rapid, so that long-term impacts of disposal on the fish community are expected to be insignificant.

MARINE MAMMALS AND MARINE BIRDS. Impacts to marine mammals and birds occurring at the BFBA should be localized and temporary. These impacts included reduced foraging success in the immediate area due to decreased visibility and available prey, avoidance of the area due to turbidity, ship-following behavior patterns, and ingestion of contaminated prey. The birds and mammals forage throughout the area, so that reduction in prey in the immediate vicinity of disposal would not have a significant impact on the ability of the birds and mammals to obtain sufficient quantities of food. Although ship-following behaviors may alter normal passage of some birds, these changes would be temporary while disposal activities occur. Disposal would be least disruptive if it occurred when migrating bird species are not abundant in the area (e.g., abundant in February).

Ingestion of contaminated prey items is not expected to occur in birds, which may feed off mollusks, crustaceans, or fish in the area, since neither benthic infauna nor fish are expected to significantly bioaccumulate contaminants. Prey found within the BFBA are not the only source of nourishment for the birds or mammals. Thus, biomagnification of contaminants within birds and mammals is expected to be insignificant. Once the cap of suitable material is placed or if only suitable material is disposed at the site, bioaccumulation within tissues would be insignificant.

Because birds and mammals are capable of avoiding the dredge plume and can forage in areas other than the release site, impacts are expected to be temporary and localized. Biomagnification of contaminants in the birds and mammals is expected to be minimal, particularly after cap placement occurs or if only suitable material is disposed at the site. If disposal occurs at times when fewer wintering waterfowl or least terns are present, potentially significant impacts to marine mammals and birds would be avoided.

THREATENED, ENDANGERED AND SENSITIVE SPECIES. Two endangered bird species observed in the vicinity of the BFBA are the California least tern and California brown pelican. Potential impacts of disposal to these species are similar to those described above (Marine Mammals and Marine Birds), including temporary reductions in available prey, decreased visibility, and ingestion of contaminated prey. Both least terns and brown pelicans feed on pelagic fishes, such as anchovies and silversides, which are highly mobile and can avoid the disposal plume. Although abundance of prey may be reduced at the release site, both bird species forage in other areas of the bay, and may continue to feed in the general vicinity of the borrow area.

Because these fish are able to avoid the dredge plume and spend most of the time in the water column, bioaccumulation of any contaminants associated with the dredged material should be minimal. If only suitable material is disposed at the site or once the cap of suitable material is in place, biomagnification of contaminants in the two endangered species would be insignificant. Since unsuitable material in each cell will be capped immediately following the one-month disposal period for each cell, bioaccumulation is not expected to occur within the fish or the bottom dwelling invertebrates at the site on which the fish feed. Therefore, bioaccumulation is not expected to be significant to an extent that would affect the birds that feed on the fish. Thus, the impacts of dredged material disposal would have no effect on the continued existence of the least tern and California brown pelican.

Mitigation Measures

Measures to minimize impact to the BFBA biological community, as described in section 4.2.7.3, include minimizing the length of time between placement of contaminated sediment and cap placement, accurate positioning to assure that sediment is placed within the target zone, bathymetric monitoring to assure proper placement of material, and operational methods to reduce turbidity and sediment transport of material on disposal. To prevent any possible water quality violations, particularly for sediments having the lowest LC50 value (LC50 = 31.5 percent), for material to be disposed at the BFBA, disposal should occur when current velocities are below 1.15 feet per second or material should be disposed in the areas other than the southeast corner of the site. These measures are expected to prevent adverse effects on biota potentially resulting from degradation of water quality following disposal. Other measures will be taken to ensure adequate cap placement and minimize resuspension of contaminated material during placement activities. Monitoring of the cap will occur periodically to ensure that the cap is effective in containing the contaminated sediment, as described in section 4.2.7.3. Another measure will be to manage disposal to avoid nearshore impacts on migrating bird species when they are abundant in the area (e.g., winter waterfowl are abundant in the area in February).

4.4.5.4 Leonard Ranch/Redwood Landfill

Project Impacts

Construction of perimeter levees and filling drying ponds with dredged material would result in filling of approximately 31 acres of existing wetlands. These areas include seasonally inundated freshwater marsh within the agricultural fields (29 acres) and the network of internal and perimeter ditches (2 acres) that drain the site. This is considered a significant adverse impact because it would result in the loss of on-site wetland resources, which conflicts with state and federal policies.

Construction of perimeter levees and filling drying ponds would result in the loss of approximately 152 acres of agricultural field habitat. This area is currently used by insects, amphibians, reptiles, mammals, and birds. Project implementation would result in the loss of foraging habitat for most of these animals, as well as the direct mortality of individuals unable to escape and/or colonize adjacent habitat during construction activities. Because of the disturbed nature of the site and relatively low habitat value it provides, this impact is considered to be not significant.

Construction of the perimeter levee along the southern portion of the site would result in the loss of a colony of small spikerush growing within a 30-square-foot area. This plant is on California Native Plant Society (CNPS) List 4 and is not considered rare from a statewide perspective because its vulnerability to threat appears low at this time. This impact is considered to be not significant.

Construction activities can interfere with wildlife behavior and result in stress or habitat abandonment. Activities associated with installation of the pipeline could result in nest abandonment by special-status avian taxa (i.e., California clapper rail) in the area. This is a potentially significant impact. Noise generated from operation of the unloading station and booster pumps may affect sensitive vertebrate wildlife receptors in the area. Peak noise levels associated with a 2,000-hp suction dredge pump at the unloading station and an 800-hp booster pump are assumed to be 80 dBA and 75 dBA, respectively, at a distance of 50 feet from each pump. Because of the relatively low background noise levels and the

potential for noise adversely affecting special-status taxa in the area, this impact is considered to be potentially significant.

An evaluation of upland disposal of Oakland Harbor sediment was conducted by the WES to determine the potential for toxicity and contamination of plants and animals that might colonize the disposal site (Lee et al. 1993). Plant and earthworm bioassays were conducted on one composite sample from Oakland Inner Harbor and one composite sample from Oakland Outer Harbor. Air-dried sediment from both the Inner and Outer Harbors was toxic initially to both plants and earthworms. However, once the salt was leached from the dried sediment, both plants and earthworms survived. Growth of plants was poor and tissue contents of cadmium, lead, and selenium appeared to be elevated in plants grown in Oakland Outer Harbor sediment. Likewise, growth of earthworms in salt-leached sediment was still poor, and the earthworms bioaccumulated arsenic to levels that were equal to or above the Australian FDA-type action level of 10 $\mu\text{g/g}$ for shellfish and fish. Levels of PAHs bioaccumulated in earthworms appeared to be higher from Oakland Inner Harbor in comparison to Oakland Outer Harbor. These elevated PAH and arsenic levels in earthworms appear to suggest the need for management practices to isolate these compounds from foodwebs that may become established on the dredged material. However, PAHs rapidly break down in sunlight and oxygen, and may be substantially reduced after drying.

This potential impact on higher trophic levels is not significant in the long term, as the dried dredged material will be transported to the Redwood Landfill for other uses. In the short term, during the drying period the site will be managed to limit its attractiveness to higher trophic levels, such as birds, by rapid draining of the sediments. Therefore, this impact is not considered significant.

Increased ponding at the dewatering site and the newly created seasonal wetlands could increase local mosquito populations. This is considered a potentially significant adverse impact.

IMPACTS OF DREDGED SEDIMENT TRANSFER OPERATIONS

Localized impacts from the dredged sediment transfer operations can be classified into three basic effects. The short-term effects of pipeline construction and removal and the transfer operations, plankton entrainment, and the potential effects of a spill from the transfer operation or pipeline failure.

The short-term localized effects of the pipeline construction and removal, discharges from vessels and anchoring disturbances, would include impacts of the turbidity plume on plankton and benthic organisms and the physical disturbance of the intertidal and nearshore subtidal substrata. Operational disturbances at the point of transfer from barges to the pumping units could affect benthic communities in and around the point of activity. These disturbances could affect benthic communities along the pipeline route and at the transfer station by disrupting feeding and respiration. The plankton could be minimally impacted by the sediment plume at a greater distance from the pipeline route. Impacts upon the primary production (phytoplankton) and the secondary production (zooplankton) would be slight. These construction and operational impacts may temporarily interfere with phytoplankton productivity and zooplankton feeding and respiration within a few hundred yards of the transfer activity. Contaminant spills (e.g., fuel or light lubricating oils) could affect plankton and benthic communities some distance from the spill point depending on the volume and type of contaminant spilled. The use of heavy anchors for barges and other support ships would disturb the benthic communities around the staging areas from dredged sediment transfer. The placement and removal of anchors could cause disturbance of the sediments and thus affect feeding and respiration of benthic organisms.

Plankton entrainment during the pumping operations would result in the physical destruction of local plankton sucked into the pump intakes. This area is known to be a habitat for young striped bass which forage in the nearshore areas. Potential removal of larval shrimp and crab during pumping could affect the localized abundance of these food sources for small striped bass. In addition, there is a possibility of larval striped bass (post egg sac or fingerling stages) occurring in the plankton in this part of the bay. The effect would occur during the duration of the striped bass migration.

Young of year striped bass migrate through the estuary in late spring. The potential for bass entrainment is limited to the late spring during the migration. As the striped bass increase in size, the chance of striped bass entrainment/impingement decreases. The effects of site water pumping would be limited in location and time and are not considered significant.

In the case of a pipeline break, sediment would be discharged until pumping was terminated and the volume of sediment in the pipe flowed out. The discharge of the sediment would directly impact the benthic communities by physically covering the organisms. The size of the area impacted would depend upon the volume of sediment discharged, the duration of the spill, and the prevailing wind and tidal currents during the spill event. Some effect on plankton would also occur because of the turbidity plume caused by the loss of sediment from the pipeline. Impacts from pipeline breaks are potentially significant.

Mitigation Measures

Wetland impacts, construction-related impacts, and contaminant and mosquito problems associated with ponding were identified as either significant or potentially significant as the result of the proposed Leonard Ranch project. Measures to mitigate these impacts are described below.

On-site/in-kind wetland replacement mitigation would be provided in the 42-acre agricultural field immediately on the western portion of the Leonard Ranch site (Figure 4.4.5.4-1), through soil compaction and the cessation of pumping and cultivation practices. Approximately 24 acres of this field could be excavated and flooded to create new seasonal wetland.

Off-site/in-kind wetland replacement mitigation would also be provided on the 248-acre northern portion of the former Leonard Ranch called the North Marsh Site. This site consists of diked, subsided historic tidelands currently in oat hay production. The North Marsh Site supports degraded seasonal wetlands and croplands that provide opportunities for wetland enhancement and creation. Approximately 108 acres of seasonal wetland and 5 acres of channels occur on site, as determined by the Coastal Conservancy (COE 1993f). Under the plan proposed for site enhancement, increased water ponding would be used to create shallow ponded wetlands over the entire 248-acre site, providing up to 135 acres of new seasonal wetland. Over both the Leonard Ranch and North Marsh sites, a total of 161 acres of new seasonal wetland would be created and 124 acres of existing wetland would be enhanced and protected from agricultural use and disturbance (Figure 4.4.5.4-1). Implementation of the Leonard Ranch rehandling facility would result in filling 29 acres of seasonal wetland and 2 acres of brackish marsh and creation of 161 acres of new seasonal wetland. This represents a 5:1 mitigation ratio.

Authorization for the discharge of dredged materials must be obtained from the Corps under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Compliance with the terms of the Corps discharge permit would reduce this wetland impact to an insignificant level.

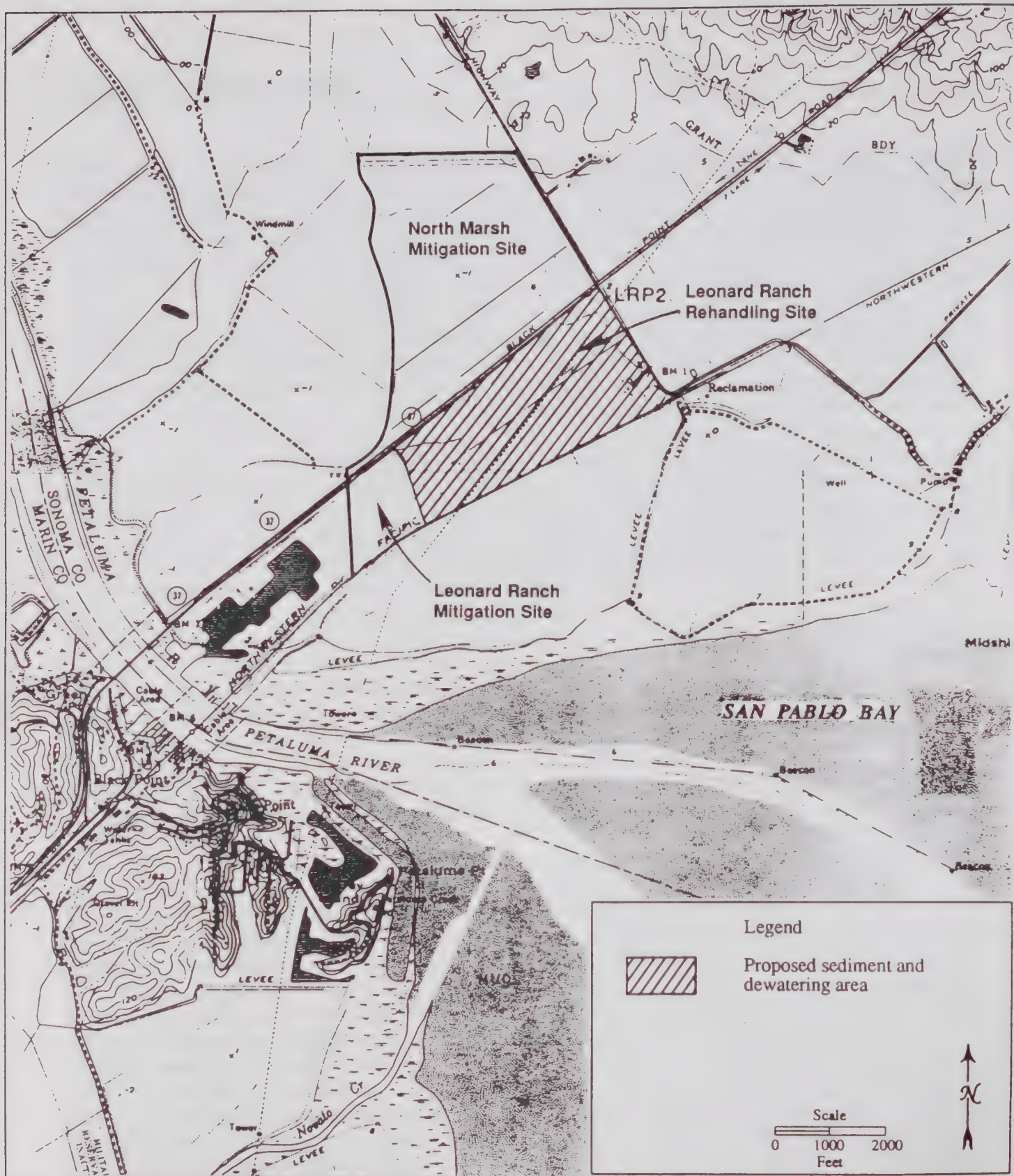


Figure 4.4.5.4-1

LEONARD RANCH REHANDLING SITE, LEONARD RANCH MITIGATION SITE, AND NORTH MARSH MITIGATION SITE

Mitigation is necessary to control noise generated from the off-loading platform and booster pump. Pumps should be fitted with mufflers and surrounded by an insulated enclosure that reduces noise to no more than 65 dBA at a distance of 50 feet from the pump. These measures would reduce this impact to a less than significant level.

Construction work on the bayfront levee and placement or removal of the pipeline during the California clapper rail nesting season would be avoided, unless surveys by a qualified biologist indicate that clapper rails are not nesting within 500 feet of the construction area. Pipeline placement across the tidal wetlands would be restricted to the existing berm southwest of the pipeline site.

Appropriate grading and ditching of the rehandling facility would reduce ponding and therefore the attraction of the site to birds would reduce exposure of birds to water-borne contaminants to insignificant levels. These physical controls would reduce this impact to a less than significant level. Implementation of a mosquito abatement plan approved by the Marin/Sonoma Mosquito Abatement District would mitigate potential mosquito impacts to a less than significant level.

Impacts from construction of the pipeline and pumping operation would be local and insignificant if proper precautions are taken to confine the necessary disturbances to the smallest area possible along the pipeline route. Anchoring disturbances could be minimized by setting mooring anchors for the duration of the project, thus avoiding the placement and removal of the barge anchors. Careful handling of fuel during transfer and storage on the pumping platform would reduce the likelihood of spills.

Potential impacts from breaks in the slurry pipeline could be mitigated by either installing a warning device attached to the end of the discharge pipe so that a break would be detected, or by regular visual observations made at the discharge point and along the levees to ensure the sediments are flowing from the pipe and are confined to designated areas.

4.4.5.5 Sonoma Baylands

Project Impacts

The project would result in the replacement of 55 acres of seasonal wetland and 1.3 acres of brackish marsh, with 289 acres of saline wetlands and the potential for 24 acres of seasonal wetlands. Because the project would result in a net increase in wetland values and area, the conversion of these habitats is considered a substantial beneficial impact.

Restoration of 289 acres of northern coastal salt marsh would increase the total acreage of tidal marshlands in the San Francisco Bay Area by approximately 1 percent. Use of dredged sediments and natural sedimentation is expected to produce a salt marsh within a period of 10 to 20 years. During this period, the succession of open water, intertidal mudflat, and salt marsh, separated by branched interior peninsulas would enhance productivity at all trophic levels and substantially increase species diversity and richness, compared to the agricultural field and seasonal wetlands currently on site. The open water and intertidal mudflat would provide habitat for diverse groups of invertebrates, fish, and birds. The marsh would provide habitat opportunities for numerous special-status taxa including soft bird's-beak, Marin knotweed, California clapper rail, California black rail, San Pablo song sparrow, Suisun ornate shrew, and salt marsh harvest mouse. Perimeter and interior levees could also support marsh gumplant.

An additional enhancement project by the Coastal Conservancy would also create 24 acres of seasonal wetlands in a band between the northern edge of the perimeter levee and the drainage ditch. Ponding within this band would provide conditions for a variety of annual and perennial plants that could support a diverse group of invertebrate and vertebrate fauna. Open ponds would provide resting sites for migratory waterfowl and refuge sites for shorebirds during high tides associated with storm events.

The project would result in the loss of approximately 285 acres of hayfield habitat and 5 acres of nonnative annual grassland. Grading of the existing levee to eliminate red fox denning habitat would convert an additional 5 acres of non-native annual grassland to northern coastal salt marsh. These areas are currently used by insects, amphibians, reptiles, mammals, and birds. The Sonoma Baylands project would result in the loss of foraging habitat for most of these animals (including northern harrier), as well as direct mortality of individuals unable to escape construction activities. Because of the disturbed nature of the site and relatively low habitat value it provides, this impact is considered to be not significant.

Breaching of the perimeter levee to initiate tidal circulation and subsequent scouring of two existing channels would result in the conversion of approximately 7 acres of northern coastal salt marsh to open channel. Because of the net increase in tidal habitat and since the channels will increase species diversity in the area, this impact is considered to be not significant.

The project would result in the loss of 1.4 acres of eucalyptus woodland. Because of the relatively low habitat values provided by this woodland, its loss is considered to be not significant.

Construction activities can interfere with wildlife behavior and result in stress or habitat abandonment. Activities associated with installation of the pipeline, breaching the levee, and scouring the outlet channel could result in nest abandonment by special-status avian taxa in the area. This is a potentially significant impact. Noise generated from operation of the unloading station and booster pumps may affect sensitive vertebrate wildlife receptors in the area. Peak noise levels associated with a 2,000-hp suction dredge pump at the unloading station and an 800-hp booster pump are assumed to be 80 dBA and 75 dBA, respectively, at a distance of 50 feet from each pump. The northern coastal salt marsh along San Pablo Bay supports sensitive species. Because of the relatively low background noise levels and the potential for noise adversely affecting special-status taxa in the area, this impact is considered potentially significant.

Only material that has been found suitable for wetland cover according to RWQCB guidelines and unconfined ocean disposal is proposed for wetland creation/restoration at the Sonoma Baylands site. The U.S. Army Engineer Waterways Experiment Station (WES) also evaluated the suitability of the Port of Oakland sediments for wetland creation/restoration (Lee et al. 1991). The wetland plant and animal bioassay tests reported by Lee et al. (1991) evaluated one composite sample of Oakland Outer Harbor sediment to a depth of 42 feet, one composite sample of Oakland Inner Harbor sediment to a depth of 42 feet and one composite sample of Oakland Inner Harbor sediment to a depth of 39 feet. Some of the sediments tested by the WES included material that has since been determined to be unsuitable for unconfined aquatic disposal or unsuitable for wetland cover according to the RWQCB's interim sediment screening criteria, and therefore is not proposed for use at the Sonoma Baylands site. Consequently, the WES test results are conservative and represent the worst case estimate of bioaccumulation in wetland plants and animals. In general, the WES evaluation indicates that the proposed wetland restoration project using Oakland material should result in wetland conditions with equal or perhaps less bioaccumulation

potential than that which occurs in existing natural wetlands in the San Francisco Bay area. The discussion in the following two paragraphs should therefore be viewed as a worst case analysis.

As part of the WES analysis, wetland plants (*Spartina alterniflora*, *Spartina foliosa*, and *Salicornia subterminalis*) and animals (snails, *Nassarius* sp., mussels, *Modiolus* sp., and annelids, *Nephtys* sp.) were exposed to Oakland sediments under controlled laboratory greenhouse conditions. An additional test was conducted in 1993 using snails and the clam, *Macoma nasuta*. The purpose of the tests was to determine if the Port of Oakland sediments were potentially toxic to wetland plants and animals and whether plants and animals would potentially become contaminated from the sediments placed under an intertidal wetland environment. At the same time, a field survey of existing wetland plants and animals in the San Francisco Bay area was conducted and reported in Lee et al. (1994). The purpose of the field survey was to establish baseline contaminant concentrations for existing wetland sediments, plants, and animals for comparison to wetland creation testing of dredged material for San Francisco Bay.

Laboratory wetland bioassay test results indicated that Oakland Outer Harbor sediments can be used for wetland creation and will potentially produce plants and animals containing levels of contaminants similar to existing wetlands in the San Francisco Bay area. Both Oakland Inner Harbor sediments produced plants and animals containing levels of most contaminants similar to existing wetlands except for certain pesticides in wetland plants that could potentially reach FDA action levels for animal feed. In addition, the shallower Oakland Inner Harbor sediments to a depth of 39 feet showed bioaccumulation of tributyltin in snails, mussels, and clams higher than that of animals exposed to existing wetland reference sediments. Clams showed bioaccumulation of pyrene higher than clams exposed to existing wetland reference sediments at magnitudes of > 10 times, > 6 times, and > 4 times for Oakland Inner Harbor (39 feet), Oakland Inner Harbor (42 feet) and Oakland Outer Harbor (42 feet), respectively. Based on these test results, Lee et al. recommended that Oakland Inner Harbor sediments not be used for wetland creation as unrestricted cover materials, but could be used as restricted noncover material that would be covered with more suitable material. Lee et al. recommended that Oakland Outer Harbor sediments could be used as cover material for wetland creation. The growth of *Spartina alterniflora* in the plant bioassay was poor in Oakland Harbor sediments and was thought to be due in part to a possible zinc deficiency in the plants. Plants grown in Oakland Harbor sediments contained approximately 1/10 the normal content of zinc observed in existing wetlands. Zinc deficiency would not be expected to be a problem for vegetation developing at the Sonoma Baylands site, because the sediments will be supplemented by naturally settling material.

Some of the material proposed for use in wetland restoration consists of sand from the Merritt sand formation. The Merritt sands contain elevated levels of chromium that are natural and not from anthropogenic sources and that may exceed the RWQCB's sediment screening criteria (SSC). In addition, the toxicity and bioavailability of chromium are determined by its valence state and form. The most toxic form of chromium is the hexavalent state. The trivalent state is the next most toxic form, but is many times less toxic than the hexavalent form (Oshida et al. 1976; Eisler 1986; Ecological Analysts 1981). Hexavalent chromium is readily reduced to the stable trivalent form. Although the reverse reaction does occur, it is extremely slow in comparison to the reduction of hexavalent chromium and not considered significant. Because it is rapidly reduced, hexavalent chromium is uncommon in marine sediments, although it may be the predominant dissolved form in marine waters. Chromium in Merritt sand is predominantly contained in the crystalline matrix and is extremely slow to dissolve under normal environmental conditions. However, this chromium will dissolve in the strong acids used in bulk sediment chemical analysis procedures. Recent testing of sediments from the Port of Oakland area with

Impacts -- Biological Resources

previously reported high levels of total chromium (acid digested, all forms of chromium) indicate that there is no hexavalent chromium and only extremely low concentrations of soluble chromium, just above the detection limit (Battelle 1993). Although Port of Oakland sediments do exhibit elevated levels of chromium when compared to wetland background levels, it is neither significantly toxic or bioaccumulative compared to existing wetland areas.

IMPACTS OF DREDGED SEDIMENT TRANSFER OPERATIONS

The impacts of dredged sediment transfer operations for Sonoma Baylands would be the same as that described for Leonard Ranch in section 4.4.5.4.

Mitigation Measures

Construction-related impacts to special-status taxa were identified as potentially significant as a result of the proposed Sonoma Baylands project. Measures to mitigate this potential impact are described below.

Mitigation is necessary to control noise generated from the off-loading platform and booster pump. Pumps should be fitted with mufflers and surrounded by an insulated enclosure that reduces noise to no more than 65 dBA at a distance of 50 feet from the pump. These measures would reduce this impact to a less than significant level.

Construction work on the bayfront levee and placement or removal of the pipeline during the California clapper rail nesting season would be rescheduled or relocated away from nesting areas during the nesting season (February through August), unless surveys by a qualified biologist indicate that clapper rails are not nesting within 500 feet of the construction area. Pipeline placement across the tidal wetlands would be restricted to the existing berm southwest of the pipeline site.

Only sediment from Oakland Harbor that is suitable for unrestricted aquatic disposal and suitable as cover material according to the interim sediment screening criteria will be placed at Sonoma Baylands.

The mitigation measures for impacts associated with dredged sediment transfer operations for Sonoma Baylands would be the same as that described for Leonard Ranch in section 4.4.5.4.

4.4.5.6 Galbraith Golf Course

Project Impacts

Land-clearing activities would result in the temporary loss of turf areas and ornamental landscaping along fairways of the golf course (129 acres). The site provides potentially suitable habitat for special-status taxa reported to occur in the area (see Appendix C, Table C-2). The managed landscape provides foraging habitat for a variety of wildlife taxa in the area, including burrowing owl and numerous other special-status avian visitors listed in this table. Because of the low habitat quality provided by this highly managed landscape, loss of golf course vegetation would not be considered significant. A pre-construction survey will be performed to determine if owls are currently using burrows on the site. If so, the burrows and owls will be relocated off site.

1 Approximately 12 acres of the entire site have been identified as wetlands (Figure 3.4.3.6-2). Clearing,
2 construction of perimeter levees, and discharge of dredged materials into cells will result in the loss of
3 up to 3.7 acres of seasonal wetlands, tidal wetlands, and other waters of the United States (exact acreage
4 to be determined by the Corps). This is considered to be a significant adverse impact.
5

6 Dewatering areas could attract shorebirds and waterfowl. Increased bird activity in the local area would
7 increase (statistically) the risk of bird-aircraft collision. The statistical risk is not considered a significant
8 impact to biological resources. The risk to aircraft and airport operations is not quantifiable, but is
9 considered avoidable by reducing the attractiveness of the site.
10

11 Seasonal ponding could increase the local mosquito population. This is considered a potentially
12 significant adverse impact.
13

14 This potential impact on higher trophic levels is not significant in the long term, as the dried dredged
15 material will be covered with topsoil and landscaped. In the short term, during the drying period the site
16 will be managed to limit its attractiveness to higher trophic levels, such as birds, by rapid draining of the
17 sediments and an active crust management program. Therefore, this impact is not considered significant.
18

19 An evaluation of upland disposal of Oakland Harbor sediment was conducted by the WES to determine
20 the potential for toxicity and contamination of plants and animals that might colonize the disposal site
21 (Lee et al. 1993). Plant and earthworm bioassays were conducted on one composite sample from
22 Oakland Inner Harbor and one composite sample from Oakland Outer Harbor. Air-dried sediment from
23 both the Inner and Outer Harbors was toxic initially to both plants and earthworms. However, once the
24 salt was leached from the dried sediment, both plants and earthworms survived. Growth of plants was
25 poor and tissue contents of cadmium, lead, and selenium appeared to be elevated in plants grown in
26 Oakland Outer Harbor sediment. Likewise, growth of earthworms in salt-leached sediment was still poor,
27 and the earthworms bioaccumulated arsenic to levels that were equal to or above the Australian FDA-type
28 action level of 10 $\mu\text{g/g}$ for shellfish and fish. Levels of PAHs bioaccumulated in earthworms appeared
29 to be higher from Oakland Inner Harbor in comparison to Oakland Outer Harbor. These elevated PAH
30 and arsenic levels in earthworms appear to suggest the need for management practices to isolate these
31 compounds from foodwebs that may become established on the dredged material. However, PAHs
32 rapidly break down in sunlight and oxygen, and may be substantially reduced after drying. Sampling
33 dried soils for PAHs and careful grading of the site to ensure that any areas where total PAHs exceed
34 5 ppm are well covered with landscape soils should reduce this potential impact. This potential impact
35 on higher trophic levels is not significant in the long term as the dried dredged material will be covered
36 with topsoil and landscaped. In the short term, during the drying period, the site will be managed to limit
37 its attractiveness to higher trophic levels, such as birds, by rapid draining of the sediments and an active
38 crust management program. Therefore, this impact is not considered significant.
39

40 Excessive noise can interfere with wildlife behavior and result in stress and habitat or nesting
41 abandonment. Noise generated from site preparation activities and operation of the unloading station and
42 booster pumps may affect sensitive wildlife receptors (vertebrates) in the area. Peak, unshielded noise
43 levels associated with equipment that would be used at the golf course could range from 75 to 88 dBA
44 at a distance 50 feet from the source. Sensitive biological noise receptors in the vicinity of the golf
45 course include an active burrowing owl nesting site to the north and a marsh to the south that provides
46 foraging habitat for northern harrier. During construction, these receptors would be subject to noise
47 levels ranging from 40 to 65 dBA for the burrowing owl nest and 40 to 70 dBA for the marsh.

Impacts -- Biological Resources

Considering the short duration of the construction activities and the current high levels of background noise (see section 3.6), this impact is considered not significant.

Peak noise levels associated with a 1,740-hp suction dredge pump at the unloading station and an 800-hp booster pump are assumed to be 80 dBA and 75 dBA, respectively, at a distance of 50 feet from each pump. Under Option A, a suction dredge pump would be stationed in San Leandro Bay. Arrowhead Marsh supports sensitive biological receptors and is located approximately 3,300 feet southeast of the proposed pump station. This marsh provides nesting and foraging habitat for California clapper rail. The marsh would be subject to pump noise ranging from approximately 40 dBA (southwestern area) to 45 dBA (northeastern area). Under Option B, a suction dredge pump would be stationed in San Francisco Bay west of the site. Bay Farm Island supports sensitive biological receptors and is located approximately 2,000 feet northeast of the proposed pump station. This area provides nesting habitat for California least tern and burrowing owl. Bay Farm Island would be subject to pump noise ranging from approximately 40 dBA (northern area) to 50 dBA (western area). Considering the current high levels of background noise in the area and distances to sensitive biological receptors identified in this analysis, noise generated by the suction dredge pumps would not be considered significant.

Under either pumping option, a booster pump would be stationed at Galbraith Golf Course. Sensitive biological receptors in the vicinity of the golf course include an active burrowing owl nesting site to the north and resident marsh animals to the south. These receptors would be subject to estimated pump noise ranging from 40 to 50 dBA, depending upon the pump location. Given the current ambient noise levels at the site, this impact is considered not significant.

IMPACTS OF DREDGED SEDIMENT TRANSFER OPERATIONS

Localized impacts from the dredged sediment transfer operations can be classified into three basic effects. The short-term effects of pipeline construction and removal and the transfer operations, longer-term effects of plankton entrainment, and the potential effects of a spill from the transfer operation or pipeline failure.

The short-term localized effects of the pipeline construction and removal, discharges from vessels and anchoring disturbances, would include impacts of the turbidity plume on plankton and benthic organisms and the physical disturbance of the intertidal and nearshore subtidal substrata. Operational disturbances at the point of transfer from barges to the pumping units could affect benthic communities in and around the point of activity. These disturbances could affect benthic communities along the pipeline route and at the transfer station by disrupting feeding and respiration. The plankton could be minimally impacted by the sediment plume at a greater distance from the pipeline route. Impacts upon the primary production (phytoplankton) and the secondary production (zooplankton) would be slight. These construction and operational impacts may temporarily interfere with phytoplankton productivity and zooplankton feeding and respiration within a few hundred yards of the transfer activity and could effect more sensitive larvae farther away. Contaminant spills (e.g., fuel or light lubricating oils) could affect plankton and benthic communities some distance from the spill point depending upon the volume and type of contaminant spilled. The use of heavy anchors for barges and other support vessels would disturb the benthic communities around the staging areas for dredged sediment transfer.

Plankton entrainment would occur from the pumping operations and result in the physical destruction of local plankton sucked into the pump intakes. The removal of the plankton could affect local benthic

communities by reducing the available food. This effect would occur during the duration of the sediment transfer operations.

In the case of a pipeline break, sediment would be discharged until pumping was terminated and the volume of sediment in the pipe flowed out. The discharge of the sediment would directly impact the benthic communities by physically covering the organisms. The size of the area impacted would depend upon the volume of sediment discharged, the duration of the spill, and the prevailing wind and tidal currents during the spill event. Some effect on plankton would also occur because of the turbidity plume caused by the loss of sediment from the pipeline.

Mitigation Measures

As soon as practical after dewatering and drying out the dredged material, an appropriate cover of top soil should be applied to the site to restrict plant and soil invertebrate contact with the dredged material.

Discharge of fill into wetlands and mosquito population increases were identified as significant and potentially significant impacts, respectively. Measures to mitigate these impacts are described below.

The largest and most valuable wetland on the Galbraith site would not be affected by the project. Compensatory on-site mitigation would be provided for wetlands that cannot be avoided at a ratio of 1.1:1 to 1.3:1 on an acreage basis. The final ratio will be determined once the design of the mitigation areas is finalized and permitted (Figure 2.7.6-1). The variance depends on the design of the wetland edge and buffer areas since the absolute acreage available is limited by two factors: (1) FAA regulations regarding creation of features to attract wildlife within the runway protection zones; and (2) the limited acreage of undeveloped upland areas within the Metropolitan Oakland International Airport. The proposed mitigation areas will be designed to provide greater habitat value than the existing wetlands to be replaced because they will be contiguous and maintained. This would mitigate wetland impacts to a less than significant level.

Implementation of a mosquito abatement plan approved by the Alameda County Mosquito Abatement District would mitigate potential mosquito impacts to a less than significant level.

Impacts from the construction of the pipeline and pumping operation would be local and considered insignificant if proper precautions are taken to confine the necessary disturbances to the smallest area possible along the pipeline route. Anchoring disturbances could be minimized by setting mooring anchors for the duration of the project, thus avoiding the placement and removal of the anchors. Careful handling of fuel during transfer and storage on the pumping platform would reduce possible spills. The potential impacts from a pipeline break or leak could be mitigated by either installing a warning device attached to the end of the discharge pipe so that a break would be detected, or by regular visual observations at the discharge point and along the levees to ensure that sediments are flowing from the pipe and are confined to designated areas.

4.4.5.7 Port/Landfill

There are no biological resources at the Port site at the Ninth Avenue Terminal, and thus no potential biological impacts. Any potential biological impacts at any of the landfills would be adequately mitigated through the permit conditions for those facilities, so do not require analysis for the proposed project.

4.4.5.8 Montezuma Wetlands

Table 4.4.5.8-1 summarizes those impacts and mitigation measures identified by Solano County (1993) for development of the Montezuma Wetlands Project as a whole, which SAIC's preliminary evaluation suggests may be applicable to the Port of Oakland's use of Phase I. Development of the project's Phase I using Oakland dredged materials would cause the loss or modification of approximately 576 acres of jurisdictional wetland habitat (predominantly grassland) that, as a result of project design, may be converted to alternative types of wetland and aquatic habitats. Existing wetlands that would be affected within Phase I are seasonally important to shorebirds and migrating waterfowl. Areas that would be impacted as part of Phase I include 2 acres of brackish marsh, 15 acres of seasonal pickleweed marsh, 9 acres of seasonal saltgrass/mixed halophyte wetland, 2 acres of brackish pond, 9 acres of open water, and 1.2 acres of alkali vernal pools (Table 22, Biological Resources, Montezuma Wetlands Project Draft EIR/S). Phase I is intended to restore tidal wetlands to the site, including creation of 315 acres of tidal salt marsh. Leaching or plant uptake of contaminants in dredge spoils may allow these contaminants to enter the food chain and potentially affect sensitive wildlife species, including state and federally protected fish and migratory bird species. Losses of habitat and population may occur for a number of sensitive plant and wildlife species on the site. Mitigation measures include the refinement of site design plans to enhance the likelihood of successful wetlands restoration, construction of a pilot project to evaluate potential containment effects, and mitigation measures for sensitive plant and animal species to be developed as required by state and federal agencies. Other significant impacts and mitigation measures identified by Solano County are listed in Table 4.4.5.8-1.

Table 4.4.5.8-1. Impacts and Mitigation Measures for the Montezuma Wetlands Alternative
(page 1 of 2)

Impacts	Potential Mitigation Measures
Delayed plant establishment could lead to a temporal loss of wetland vegetation.	Set performance standards and time deadlines for plant establishment.
Irrigation could cause acidic hypersaline soils, which would not support wetland vegetation.	Use dredged material with low acid potential or treat material with an alkaline amendment such as lime.
Proposed elevations might not result in optimum vegetation establishment.	Establish marsh elevations that are within the vertical distribution of targeted plant species, in proportion to percent cover for each species. Establish elevations of 9 inches above mean high water for pickleweed replacement.
Plant uptake of contaminants could occur, transferring contaminants up the food chain.	Construct a pilot project and allow no placement of contaminated materials elsewhere until the pilot project demonstrates that toxics will not damage fish and wildlife.
1.2 acres of vernal pools would be filled within Phase I and could be affected by infrastructure vehicular traffic, hydraulic change, and other construction activities elsewhere.	Recreate vernal pool habitats in dredged sediment placement areas at a 3:1 ratio. Avoid vernal pools outside fill areas.
Mason's lilaeopsis (federal category 2, State rare, CNPS 1B) is within Phase I on the site. Habitat loss and takings could occur due to offloading facility construction, marine traffic wake, walkway shade, levee breaches, and changing tidal patterns.	Avoid existing colonies of this species. If avoidance is not possible, mitigate as determined by the California Department of Fish and Game, as required by the California Endangered Species Act. Successful restoration of tidal wetlands would provide new habitat for this species.
Delta tule pea (federal category 2, CNPS 1B) occurs in emergent tidal marsh in Phase I and could be affected by levee strengthening and breaching. San Joaquin saltbush (federal category 2, CNPS 3) would be affected by dredged material placement during Phase I.	Avoid existing colonies of these plants. If avoidance is not possible, mitigate as required by the California Department of Fish and Game. Successful restoration of tidal wetlands would provide new habitat for the Delta tule pea.
The project would result in the loss of 576 acres of jurisdictional wetland, which provide seasonal wetland habitat values.	Replace lost saline basins and ditches with functional tidal or non-tidal marsh.
Phase I would result in loss of 724 acres of foraging habitat for raptors. Marsh-favoring raptors on the site include northern harrier and prairie falcon. Upland-favoring raptors on the site include black-shouldered kites, ferruginous hawk, and golden eagle. Habitat losses would diminish over time through project implementation and restoration of wetlands.	Provide additional foraging habitat on a portion of the site as required by the California Department of Fish and Game.

Table 4.4.5.8-1. Impacts and Mitigation Measures for the Montezuma Wetlands Alternative
(page 2 of 2)

Impacts	Potential Mitigation Measures
The project would result in the loss of burrowing owl habitat.	Avoid active burrowing owl nesting sites, and establish buffers around the sites. If avoidance is not possible, relocate owls to suitable habitat in the upland area.
Upland habitat for loggerhead shrike and horned lark will be lost.	Provide upland areas within the tidal marsh.
Decant water in the canal and holding ponds, which could contain harmful contaminant concentrations, could attract shorebirds and waterfowl.	Construct a pilot project and allow no placement of toxic materials elsewhere until the pilot project demonstrates that toxics will not damage fish and wildlife.
The western pond turtle on the site would be lost.	Avoid western pond turtle habitat. If avoidance is not possible, mitigate as required by the California Department of Fish and Game.
Reptiles and amphibians including the red-legged frog, California tiger salamander, western spadefoot toad, and giant garter snake could occur on the site. If present, they would be lost.	A qualified biologist should survey the site to determine the presence and, if present, the locations of the red-legged frog, California tiger salamander, western spadefoot toad, and giant garter snake at the site prior to project initiation. If found, mitigate impacts to these species as required by the U.S. Fish and Wildlife Service.
The project could have unforeseen impacts on the delta smelt, a candidate State and federal threatened species known to spawn in Montezuma Slough near Suisun Bay; the winter-run Chinook salmon, a federal endangered species which migrates in the Sacramento River; and the Sacramento splittail, a federal candidate species native to Suisun Marsh and the Sacramento River.	Monitor the adjacent portions of the Sacramento River and Montezuma Slough for winter-run Chinook salmon, Sacramento splittail, and delta smelt before, during, and after project construction. If impacts are found, mitigate as required by the U.S. Fish and Wildlife Service and the California Department of Fish and Game.
Increased seasonal ponding could increase mosquito populations.	Prepare a mosquito abatement plan that meets the approval of the Solano County Mosquito Abatement District prior to project initiation, and implement the plan throughout construction and operation of the project.

Source: Solano County 1993.

4.5 CULTURAL RESOURCES

4.5.1 Impact Significance Criteria

Impacts on cultural resources were considered significant if a resource fulfilling any of National Register of Historic Places criteria would be physically damaged or altered, would be isolated from the context considered significant, or would be affected by project elements that would be out of character with the significant property or its setting.

The American Indian Religious Freedom Act of 1978 in effect requires federal agencies to allow access to federal lands and objects used in the practice of traditional Native American religious ceremonies. Title 36 CFR Part 900 addresses the consideration of Native Americans and other interested parties in the process of evaluating impacts on cultural resources. Any action that could directly or indirectly affect properties including archaeological sites, biological habitats, or topographic features associated with Native American religious practices would be considered significant under these statutes.

CEQA Appendix G, Significant Effects criteria also are applicable to the proposed project. A significant effect on cultural resources was defined if the project would:

- (j) Disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as a part of a scientific study.
- (w) Conflict with established recreational, educational, religious or scientific uses of the area.

4.5.2 Oakland Harbor

4.5.2.1 Project Impacts

Proposed dredging and the effect on the Inner Harbor jetties has been researched by the Corps of Engineers staff. Dredging would not physically encroach within the jetties' foundation existing footprint. Geotechnical studies performed indicated that dredging would not destabilize the foundations of the jetties (personal communication, Harari 1994). Therefore, impacts on these cultural resources would not be significant.

4.5.2.2 Mitigation Measures

No mitigation measures are required.

4.5.3 Disposal Site Options

4.5.3.1 Ocean Section 102

Project Impacts

As no cultural resources are identified in the project alternative site, no adverse impacts are anticipated.

Impacts – Cultural Resources

Mitigation Measures

No mitigation measures are required.

4.5.3.2 Alcatraz

Project Impacts

Due to the low likelihood for archaeological resources to be present, no adverse impacts are anticipated.

Mitigation Measures

No mitigation measures are required.

4.5.3.3 Bay Farm Borrow Area

Project Impacts

Due to extensive excavation disturbance at this site, remains of cultural resources are not likely. The proposed placement of dredged disposal sediments within the historic borrow pit would likely not adversely impact cultural resources.

Mitigation Measures

No mitigation measures are required.

4.5.3.4 Leonard Ranch/Redwood Landfill

Project Impacts

A single-family dwelling and associated outbuildings occur on the Leonard Ranch site and may be part of a turn-of-the-century farmstead. The disposal of dredged material for drying at the Leonard Ranch site, however, will not occur in the area of these structures. No other cultural resources are recorded on the Leonard Ranch site; however, the area has not been surveyed to determine if archaeological sites exist on site. Because the area is considered sensitive due to the location of sites in the vicinity, there is a potential that unknown cultural resources could be impacted. Impacts are considered potentially significant.

Mitigation Measures

No known impacts to archaeological or historical cultural resources are identified at the Leonard Ranch site. This does not, however, preclude the possibility that archaeological deposits exist that could be affected by activities associated with the proposed project. Therefore, the following is required:

If the Leonard Ranch site is selected for dredged material disposal, the impact area shall be surveyed systematically by qualified archaeologists consistent with federal, state, and local guidelines. Any cultural resources identified that cannot be avoided shall be treated

according to a Memorandum of Agreement (MOA) developed among the State Historic Preservation Officer, the Corps of Engineers, the Port of Oakland, and Solano County. The MOA shall incorporate relevant federal, state, and local guidelines for performing the phased data evaluation and, if necessary, recovery of impacted cultural resources, including significance assessment, mitigation, and evaluation and treatment of unexpected resources encountered during construction.

If unexpected, unrecorded cultural resources are encountered during construction, activities shall be temporarily redirected until a qualified archaeologist can determine the significance of the find, pursuant to local, state, and federal guidelines. If significant and unavoidable, the resource shall be mitigated pursuant to appropriate local, state and federal standards.

4.5.3.5 Sonoma Baylands

Project Impacts

No evidence of cultural resources were observed on the 348-acre Sonoma Baylands disposal site that was systematically surveyed by archaeologists (Jordan 1990). Therefore, no impacts to cultural resources are identified as a result of proposed disposal activities at that site.

Mitigation Measures

As stated above, no impacts to archaeological or historical cultural resources are identified at the Sonoma Baylands site. This does not, however, preclude the possibility that archaeological deposits exist that could be encountered during activities associated with the proposed project. Therefore, the following is required:

If unexpected, unrecorded cultural resources are encountered during construction, activities shall be temporarily redirected until a qualified archaeologist can determine the significance of the find, pursuant to local, state, and federal guidelines. If significant and unavoidable, the resource shall be mitigated pursuant to appropriate local, state and federal standards.

4.5.3.6 Galbraith Golf Course

Project Impacts

No archaeological or historical cultural resources were observed by archaeologists at the Galbraith disposal site in the few, small areas of non-vegetated golf course terrain surveyed (Chavez and Associates 1990). The site was used previously as a landfill so that native soils have been deeply buried. Therefore, no intact cultural resources are expected to occur. Therefore, no impacts to cultural resources are identified from disposal of dredged material at the Galbraith site.

Mitigation Measures

As stated above, no impacts to archaeological or historical cultural resources are expected to occur at the Galbraith site. This does not, however, preclude the possibility that archaeological deposits exist that

Impacts – Cultural Resources

could be encountered during activities associated with the proposed project. Therefore, the following is required:

If unexpected, unrecorded cultural resources are encountered during construction, activities shall be temporarily redirected until a qualified archaeologist can determine the significance of the find, pursuant to local, state, and federal guidelines. If significant and unavoidable, the resource shall be mitigated pursuant to appropriate local, state and federal standards.

4.5.3.7 Port/Landfill

There are no archaeological or historic resources at the Port site at the Ninth Avenue Terminal. Any potential cultural resources at any of the landfill sites would be adequately protected through the permits for those facilities, so they do not need to be analyzed for the proposed project.

4.5.3.8 Montezuma Wetlands

Project Impacts

Use of the alternative site would affect two historical features that are located on the Phase I disposal area, which are considered potentially eligible for inclusion on the National Register of Historic Places and are potentially significant under CEQA Appendix K criteria.

Mitigation Measures

The following measures are based on the federal *Principles in the Treatment of Archaeological Properties* developed by the Advisory Council of Historic Preservation and CEQA Appendix K, Archaeological Resources, mitigation procedures.

Dredging materials disposal shall be designed to avoid all known prehistoric and historic resources. Because surface artifact scatter boundaries have not been clearly established by subsurface excavations, a 50-foot buffer surrounding these resources shall also be avoided.

If avoidance of any prehistoric or historic site is infeasible, a MOA shall be developed among the Corps, the Port of Oakland, and Solano County. The MOA shall incorporate relevant federal, state, and local guidelines for performing the phased data recovery of impacted cultural resources, including significance assessment, mitigation, and evaluation and treatment of unexpected resources encountered during construction.

4.6 NOISE

4.6.1 Impact Significance Criteria

Appendix F of the CEQA Guidelines indicates that a project will normally result in a significant adverse impact if it causes "a substantial increase in the ambient noise level in areas sensitive to noise adjacent to the project site." Noise impacts from the proposed project were considered significant if one of the following three criteria were met:

- Noise levels for sensitive human receptors would exceed a single nighttime 1-hour L_{eq} of 55 dBA. This significance threshold is based on preventing sleep disturbance. Dwellings are typically capable of approximately 20 dBA of noise attenuation; therefore, the resulting interior noise level would be 35 dBA, a level sufficient to prevent sleep disturbance (EPA 1981).
- Noise levels for sensitive human receptors would exceed a single daytime hourly L_{eq} of 70 dBA for 10 or more days. Exceedance of noise levels for less than 10 days is considered a short-term impact; however, an exceedance of 10 or more days (a total of 10 days and not necessarily 10 days in a row) is persistent enough to cause severe annoyance. Disruption of communication in a normal voice will occur with noise levels of 66 dBA, and a disruption of communication in a raised voice will occur with noise levels of 72 dBA, based on a standard communication criteria of a distance of 1 meter (EPA 1981). The 70-dBA significance threshold was chosen to represent an average noise level at which speech interference occurs.
- Noise levels for human receptors would be in the unacceptable ranges determined by the Office of Noise Control indicated on Table 3.6.1.2-1.

4.6.2 Noise Sources

Noise sources associated with the proposed project include dredge equipment, tugboats, scows, pump-out barges, trucks and trains used to transport the dredged material, transfer station pumps, and construction equipment used to prepare the upland disposal sites. Additional detail concerning noise emissions is presented under each potential project site.

4.6.3 Oakland Harbor

4.6.3.1 Project Impacts

The existing noise levels in the Oakland Harbor area are normally very high because of the industrial land uses and airfield bordering the harbor. Noise generated from one additional ship per week and associated truck traffic would not create a noticeable increase in noise in the area. Train length may increase from the proposed project, but not by a substantial amount, as discussed in section 4.8; this would not result in a significant increase in noise along the rail line.

1 **4.6.3.2 Mitigation Measures**

2
3 No significant noise impacts are identified; therefore, no mitigation measures are required.
4

5 **4.6.4 Disposal Site Options**

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7 **4.6.4.1 Ocean Section 102**

8
9 *Project Impacts*

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11 Noise associated with this alternative would result primarily from tugboats towing scows to the disposal
12 site. No noise impacts would result from disposing of dredged material at this site since the site is well
13 removed from any sensitive receptors.
14

15 *Mitigation Measures*

16
17 No mitigation measures are required.
18

19 **4.6.4.2 Alcatraz**

20
21 *Project Impacts*

22
23 Noise associated with this alternative would result primarily from tugboats towing scows to the disposal
24 site. The site is located in the incoming traffic lane for San Francisco Bay. Due to the existing ship
25 noise in the area and the distance to the nearest sensitive receptors, there would not be any noticeable
26 change in noise at the sensitive receptors.
27

28 *Mitigation Measures*

29
30 No mitigation measures are required.
31

32 **4.6.4.3 Bay Farm Borrow Area**

33
34 *Project Impacts*

35
36 Noise associated with this alternative would result primarily from tugboats towing scows to the disposal
37 site. No noise impacts would result from disposing of dredged material at this site since no sensitive
38 receptors are present in the vicinity of the project.
39

40 *Mitigation Measures*

41
42 No mitigation measures are required.
43
44

4.6.4.4 Leonard Ranch/Redwood Landfill

Project Impacts

Sources of noise under this alternative include the unloading station, on-site construction equipment and pumps, and trucks hauling dried material to the Redwood Landfill north of Novato. No significant noise impacts are expected, as discussed below.

NOISE FROM UNLOADING STATION. Pumps at the unloading station have the potential to produce high noise levels. Based on information in EPA (1971), the peak noise level associated with the 2,000-hp unloading pump engine is assumed to be 80 dBA at 50 feet. The nearest sensitive human receptor to the unloader is approximately 1,800 feet southwest. With attenuation of sound over distance, the noise level at this receptor would be about 49 dBA. This noise level would be insignificant.

NOISE FROM CONSTRUCTION EQUIPMENT AND ON-SITE PUMPS. Equipment used for site and berm preparation has the potential to produce high levels of noise. Peak noise levels associated with equipment that would be used at the sites would range from 75 to 88 dBA at 50 feet from the source (EPA 1971). Noise from localized sources typically falls off by about 6 dBA with each doubling of distance from source to receptor. This attenuation rate does not account for natural or artificial barriers, such as structures, trees, shrubs, or topographic relief, all of which would increase the attenuation rate (resulting in lower noise levels). Assuming a peak noise level of 88 dBA and the 6 dB attenuation rate, a noise level of about 66 dBA would occur at the nearest sensitive receptor, approximately 600 feet northwest of the northwestern boundary of the site. This peak noise level of 88 dBA would occur only for a very limited period of time, when the equipment is operating in that corner of the site. This noise level would not be inconsistent with the relatively high background noise at this receptor from traffic on SR 37. There are no other human receptors within about 2,400 feet of the site. Therefore, noise impacts from construction activities would be insignificant.

An existing 60-hp drainage pump and a proposed 50-hp drainage pump would also be used at the site. It is assumed that noise levels from these pumps would be no more than 68 dBA at 50 feet. These pumps would be located at least 2,400 feet from the nearest sensitive receptors, far enough that receptors would not hear noise from the pumps. Two 800-hp booster pumps would be spaced apart in the western portion of the site and operated during unloading of sediment at the site (8 hours per day, 3 to 11 months). The location of these pumps also would be sufficiently far away from sensitive receptors so there would not be a significant noise impact during the temporary operating schedule.

NOISE FROM TRUCK TRAFFIC. Trucks carrying dried sediment from the Leonard Ranch site to the Redwood Landfill would generate noise along their route. (See section 4.8.4.4 for description of the transportation route.) Most of the route runs through rural areas with few sensitive receptors. The noise generated by the transport trucks would not be out of character with the existing noise from traffic along the route. The noise increase from the transport trucks is expected to be insignificant because of the existing relatively high noise levels along the proposed transport route.

Mitigation Measures

No mitigation measures are required.

4.6.4.5 Sonoma Baylands

Project Impacts

Sources of noise under this alternative include the unloading station and on-site construction equipment and pumps. No significant noise impacts are expected, as discussed below.

NOISE FROM UNLOADING STATION. Pumps at the unloading station have the potential to produce high noise levels. Based on information in EPA (1971), the peak noise level associated with the 2,000-hp unloading pump engine is assumed to be 80 dBA at 50 feet. The nearest sensitive human receptor to the unloader is approximately 1,600 feet west. With attenuation of sound over distance, the noise level at this receptor would be about 50 dBA. This noise level would be insignificant. The potential for noise impacts on sensitive wildlife species is discussed in section 4.4.3.5, Biological Resources.

NOISE FROM CONSTRUCTION EQUIPMENT AND ON-SITE PUMPS. Equipment used for site and berm preparation has the potential to produce high levels of noise. Peak noise levels associated with equipment that would be used at the sites would range from 75 to 88 dBA at 50 feet from the source (EPA 1971). Noise from localized sources typically falls off by about 6 dBA with each doubling of distance from source to receptor. This does not account for the increased attenuation rate (resulting in a lower noise level) due to natural or artificial barriers, such as structures, trees, shrubs, or topographic relief. Assuming a peak noise level of 88 dBA and the 6 dB attenuation rate, a noise level of about 56 dBA would occur at the nearest sensitive human receptor, approximately 1,800 feet north from the northwestern corner of the site. The peak noise level of 88 dBA would occur only for a very limited period of time, when the equipment is operating in that corner of the site. This noise level is similar to the relatively high background noise at this receptor from traffic on SR 37. No other sensitive human receptors exist within about 3,000 feet of the site. Therefore, noise impacts from construction activities would be insignificant.

An existing 60-hp drainage pump would be relocated to a new site on the inboard side of the perimeter levee, lowering noise levels at off-site receptors. It is assumed that noise levels from the pump would be no more than 68 dBA at 50 feet. The pump would be located at least 3,000 feet from the nearest sensitive human receptors, far enough that receptors would not hear noise (32 dBA) from the pumps. However, noise impacts to wildlife receptors in the area may be potentially significant, as discussed in section 4.4.3.5.

Two 800-hp booster pumps would be spaced apart in the western portion of the site and operated during unloading of sediment at the site (8 hours per day, 3 to 11 months). The location of these pumps also would be sufficiently far away from sensitive receptors so there would not be a significant noise impact during the temporary operating schedule.

Mitigation Measures

No mitigation measures are required.

4.6.4.6 Galbraith Golf Course

Project Impacts

Sources of noise under this alternative include operation of the unloading station, booster pumps, on-site construction equipment, and trucks hauling levee material to the site. At the Galbraith Golf Course site, the unloader and booster pumps could cause excessive noise, depending on their placement.

NOISE FROM UNLOADING STATION AND BOOSTER PUMPS. Pumps at the unloading stations have the potential to produce high noise levels. The peak noise level associated with the 1,740-hp unloader is assumed to be 80 dBA at 50 feet from the engine (EPA 1971). The proposed location and specifications of the unloading facility are not known at this time. If the unloader is operated during daylight hours only, it should be located at least 500 feet from the nearest sensitive human receptor (Lincoln Park and the residential area at the southeast portion of Alameda) to avoid potential noise impacts. The noise at 500 feet would be approximately 60 dBA. If the unloader is operated between 10 P.M. and 7 A.M., it should be located at least 1,600 feet from the nearest sensitive receptor to avoid potential noise impacts. The noise at 1,600 feet would be approximately 50 dBA. If noise from the unloader exceeds these levels, then there is potential for significant impacts.

The peak noise level associated with the 800 hp booster pump that would be used under both options is assumed to be 75 dBA at 50 feet from the pump (EPA 1971). The location and specifications of the booster pump are not known at this time. If the booster pump is operated during daylight hours only, it should be located at least 280 feet from the nearest sensitive receptor to avoid potential noise impacts. The noise at 280 feet would be approximately 60 dBA. If the booster pump is operated between 10 P.M. and 7 A.M., it should be located at least 900 feet from the nearest sensitive receptors to avoid potential noise impacts. The noise level at 900 feet would be approximately 50 dBA. If noise from the unloader exceeds these levels, then there is potential for significant impacts. Noise impacts to the clapper rail nest in Arrowhead Marsh are discussed in section 4.4.3.6.

NOISE FROM CONSTRUCTION EQUIPMENT. Equipment used for site and berm preparation has the potential for producing high noise levels. Peak noise levels associated with equipment that would be used at the sites would range from 75 to 88 dBA at 50 feet from the source (EPA 1971). Noise from localized sources typically falls off by about 6 dBA with each doubling of distance from source to receptor. This attenuation rate of 6 dB per doubling of distance does not account for natural or constructed barriers, such as buildings, trees, shrubs, or topographic relief, all of which would increase the attenuation rate (and create lower noise levels). Assuming the highest noise level of 88 dBA and the 6 dB attenuation rate, a noise level of about 55 dBA would occur at approximately 2,000 feet from the source. No sensitive receptors are within 2,000 feet of the site, because industrial and airport land immediately surround it. The existing noise environment in the area is also relatively loud, as discussed in section 3.6.4.6; therefore, no significant noise impacts would be made by construction equipment operating at the site.

NOISE FROM TRUCK TRAFFIC. Approximately 228,000 cy of levee material would need to be imported to the site. It is assumed that all of this material would be trucked to the site from commercial sources in the region, although some material may be extracted from on site. Material coming from commercial sources would access the site via I-880, Hegenberger Drive, Airport Road, and Doolittle Drive. As discussed in section 4.8.4.7, transportation of levee material would generate up to approximately 185 round trips per day or about 20 round trips per hour over a period of approximately 4 months. The

temporary noise impacts from these trucks are expected to be insignificant because the route does not have any sensitive receptors along it; the number of transport trucks would be relatively few compared to existing traffic, and the streets are designated truck routes.

Mitigation Measures

The unloader and booster pump could cause potentially significant impacts if proper precautions are not taken. If the unloader is operated during daylight hours only, it shall be located at least 500 feet from the nearest sensitive human receptor to avoid potential noise impacts. The noise at this distance would be approximately 60 dBA. If the unloader is operated between 10 P.M. and 7 A.M., it shall be located at least 1,600 feet from the nearest sensitive receptor to avoid potential noise impacts. The noise at this distance would be approximately 50 dBA. If the unloader cannot be located farther away, construction specifications for it shall state that noise shall not exceed 60 dBA at the nearest sensitive receptor during the hours between 7 A.M. to 10 P.M. and 50 dBA during the hours between 10 P.M. and 7 A.M.

If the booster pump is operated during daylight hours only, it shall be located at least 280 feet from the nearest sensitive receptor to avoid potential noise impacts. The noise at this distance would be approximately 60 dBA. If the booster pump is operated between 10 P.M. and 7 A.M., it shall be located at least 900 feet from the nearest sensitive receptors to avoid potential noise impacts. The noise level at this distance would be approximately 50 dBA. If the pump cannot be located farther away, construction specifications for it shall state that noise shall not exceed 60 dBA at the nearest sensitive receptor during the hours between 7 A.M. to 10 P.M. and 50 dBA during the hours between 10 P.M. and 7 A.M.

4.6.4.7 Port/Landfill

Project Impacts

Sources of noise under this alternative include on-site construction equipment, a clamshell dredge moving sediment from barges to the site, an excavator moving sediment from the site to trucks or rail cars, and from the trucks or trains hauling dried material to a disposal site.

The Ninth Avenue Terminal is surrounded by industrial and commercial land uses and is located near rail facilities and I-880. There are no sensitive receptors within 2,000 feet of the site. Because of the relatively high background noise in the area and the large distance to the nearest sensitive receptors, no significant noise impacts are expected from on-site noise sources or from transport of dried sediment from the site. The relatively low number of trucks (96 round trips per day) and trains (3 to 4 trains per month) required for transport of sediment would likely not cause a significant noise impact along the transport routes.

Mitigation Measures

No mitigation measures are necessary.

4.6.4.8 Montezuma Wetlands

Project Impacts

This analysis focuses on impacts associated with disposal of dredged sediments at this site, rather than on impacts associated with site preparation. The primary source of noise associated with this alternative would be pumps operating at the unloading station. Barges would bring dredged material to the unloading facilities at this disposal site, and the dredged sediment would be pumped through the pipeline to the designated disposal area. Diesel-powered pumps would be the noisiest piece of equipment used during this phase of the project. A 2,000-hp unloading pump engine would be used on the off-loading barge, and two 1,500-hp booster pumps would be located along the pipeline. The first would be about 6,000 feet from Collinsville Resort. Typical diesel engines of the size proposed for this project and equipped with standard mufflers generate noise levels of about 90 dBA at a distance of 50 feet (Solano County 1993; EPA 1971). Since there could be two or three pumps operating near the river, and since the first booster pump would also be about 6,000 feet away from the resort, noise levels at Collinsville with all these pumps operating simultaneously could reach 63-65 dBA (Solano County 1993).

The pumps could operate 24 hours a day. A significant impact could be expected on the residents of the Collinsville Resort. An outdoor noise level of 63-65 dBA would significantly interfere with the ability to carry on a conversation at speaker-to-listener distance greater than about 5 feet and would interfere with the ability to converse in a normal tone of voice indoors with the windows open. Some people might also find it difficult to sleep even with the windows closed. The EPA recommends that to protect against sleep disturbance, noise levels should not exceed an average level of 35 dBA in sleeping areas (EPA 1974; in Solano County 1993). Since a building with the windows open typically reduces outdoor noise levels by about 15 dBA (closed windows typically reduce outdoor noise levels by 25 dBA), indoor noise levels could be as high as 50 dBA with the windows open. With the windows closed, noise levels would be reduced by an additional 10 dBA typically to a level of about 37-40 dBA.

The Collinsville-Montezuma Hills Area Plan adopted by Solano County requires that uses in the industrial reserve area (where the pumps would be located) generate noise levels no greater than 60 dBA as measured at the boundary of the nearby Collinsville commercial recreation area. Even at a level of 60 dBA, noise levels would significantly exceed the existing background noise level in the area, would interfere with outdoor conversation at speaker-listener distances of greater than 10 feet, and could interfere with sleep. Since the background noise level in the area is typically about 40 dBA during the daytime, it was suggested in a previous environmental analysis of the Montezuma Wetlands Project (Solano County 1993) that the noise of the pumps be controlled to a level that does not exceed 45 dBA at the resort area. Even at this level, the sound of the pumps would be audible, but would not significantly exceed the background level. This recommended noise level would not interfere with outdoor or indoor activity, or with sleep even with the windows open.

Mitigation Measures

"Critical" grade silencers shall be installed on the diesel pumps and each pump shall be either completely or partially enclosed so that noise levels at the town of Collinsville do not exceed 45 dBA.

4.7 SOCIOECONOMIC ENVIRONMENT

4.7.1 Impact Significance Criteria

This impact analysis considers the economic impacts of the project. This information is provided to allow a full disclosure of project impacts and allow the public and decisionmakers to assess the comparative costs and economic benefits of the project and its alternatives. Economic impacts in themselves, however, are not considered effects on the environment and thus no significance criteria are established. As described in section 3.7, where impacts to socioeconomic resources occur that could be considered direct effects on the environment (e.g., loss of a recreational use) that are separate from strictly economic impacts (e.g., loss of revenue from a recreational use), then impacts are addressed in Chapter 5.

4.7.2 Regional

The Port of Oakland dredging project would have a beneficial, substantial, impact on the region's overall economy. It is also expected to result in a considerable change to the operations and economic climate of the Port of Oakland itself. The following section discusses the economic analysis of the proposed dredging in the Port of Oakland.

4.7.3 Oakland Harbor

The proposed project has the potential to induce more intermodal container cargo to move through the Port's existing terminal facilities. Various market factors would affect the rate and pattern of increase in cargo container activity, and would, therefore, affect the rate and pattern of economic impacts.

Table 4.7.3-1 presents three levels of shipping activity projected for the year 2000. The low level forecast is based on a scenario of no harbor deepening and is discussed below under a separate heading (see section 6.1.8). The medium and high level forecasts are based on completion of the deep-draft navigation improvement project and on current (10.4 percent) and increased (25 percent) West Coast market shares of discretionary intermodal cargo (east of the Mississippi and Texas). The medium level forecast assumes only the proposed project; the high level forecast includes the proposed project, plus other possible Port developments. These include I-880 highway replacement, construction of a Joint Intermodal Terminal, Berth 30 improvements, and perhaps some expansion into the Naval Supply Center. In some categories, intermodal rail cargo produces fewer local jobs than cargo that is trucked to nearby areas. However, intermodalism allows a greater volume of cargo to be handled through the Port, resulting in an increase in total local jobs. Projections are adjusted to account for 1992 activity, using some factors based on characteristics of the Port's 1991 cargo. All amounts are in 1991 dollars (Port of Oakland 1992).

Annual business revenue, including customs revenue, for the year 2000 with the proposed project would range from \$1,323.3 million to \$1,707.8 million. Direct jobs would range from 7,400 to 8,400, generating from \$245.2 million to \$277.7 million in personal income. Induced jobs would range from 3,200 to 3,600, generating from \$232.9 million to \$263.8 million in personal income. The total personal income from direct and induced jobs would range from \$478.1 million to \$541.5 million. Related jobs are projected to be 232,400. State, county, and local taxes generated by maritime activity would range from \$42.5 million to \$48.0 million.

Impacts -- Socioeconomic Environment

Revenue tons handled in the year 2000 would range from 20.2 million to 26.6 million. From 862,000 to 1,156,000 containers would be handled, with from 33 percent to 50 percent sent to or from the Port by rail.

The projected increase in shipping activity as a result of the proposed project would increase annual business revenue to the Port, generate new jobs and, thus, increase personal income from direct and induced jobs. Increased business revenue and personal income would result in greater contributions to the state, county, and local tax base.

Table 4.7.3-1. Port of Oakland - Economic Analysis of Dredging

	Existing 1991	YEAR 2000 PROJECTIONS		
		No Project (Low) No Harbor Deepening	(Medium) Harbor Deepening - Range of Impacts	(High)
Direct jobs	6,700	6,800	7,400 to	8,400
Induced jobs	2,900	2,900	3,200 to	3,600
Total direct and induced jobs	9,600	9,700	10,600 to	12,000
Related jobs	169,500	232,400	no change	
State, county and local taxes (million \$)	\$38.3	\$38.8	\$42.5 to	\$48.0
Total personal income (million \$)	\$429.6	\$436.0	\$478.1 to	\$541.5
From direct jobs only	\$220.3	\$223.6	\$245.2 to	\$277.7
Total business revenue, excluding customs revenue (million \$)	\$732.8	\$606.6	\$861.0 to	\$1,245.5
Total business revenue, including customs revenue (million \$)	\$1,195.0	\$1,068.8	\$1,323.3 to	\$1,707.8
Containers (mix of 20s and 40s assumed to remain constant)	669,000	666,000	862,000 to	1,156,000
Revenue tons (millions)	15.8	16.0	20.2 to	26.6
Metric tons (millions)	9.0	9.0	11.4 to	15.0
Percent of containers sent to/from Oakland by rail	33 percent	13 percent	33 percent to	50 percent

Source: Port of Oakland 1992.

4.7.4 Disposal Site Options

4.7.4.1 Ocean Section 102

This alternative is located in an area where some commercial and recreational fishing occurs. Previous studies (EPA 1992) have indicated that impacts of disposal on commercial and recreational fishing would be insignificant due to the comparatively limited resources of the area, in addition to the fact that fish would avoid the disposal plumes. Economic impacts would be negligible. Since this disposal site lies outside of designated commercial shipping lanes, the increase in tugboat traffic would have no impact on commercial shipping.

4.7.4.2 Alcatraz

Project Impacts

Use of this site for disposal of dredged materials is anticipated to have no consequences related to commercial or recreation fishing. As described in section 4.4.3.2, impacts to the fish community at Alcatraz are expected to be short term and minimal. The dredge plume would dissipate rapidly, so that reduced water clarity and physical obstructions caused by the turbidity would be short term. Fish should be able to avoid the site or tolerate disposal activities. Fish migrating through the area, such as winter-run chinook salmon and striped bass, would be able to avoid the plume. Such avoidance would not likely affect the fish catch success of certain sport fish (e.g., striped bass) (COE 1988, in COE 1992a). The Aquatic Habitat Institute reports that fish may disperse in response to dredged material disposal events, but that they return within an hour or so (Aquatic Habitat Institute 1991, in COE 1992a). Because daily dredged material disposal operations would be relatively infrequent, and since increased turbidity at Alcatraz shows little correlation to fish catch success, disposal of dredged material at the Alcatraz site is not expected to significantly impact commercial or sport fishing activities (see section 5.3.2). Therefore, economic impacts are expected to be negligible.

As described in section 4.8.4.2, no substantive impacts to commercial shipping would result from use of this disposal site.

4.7.4.3 Bay Farm Borrow Area

Project Impacts

In general, physical impacts to commercial and recreational fishing would be short term, localized, and insignificant (see section 5.3.3). As described in section 4.4.3.3, most fish would be able to avoid the plume, and while some mortality may occur as a result of burial during disposal, it is expected to be minimal. No substantive economic impacts are expected.

As described in section 4.8.4.3, no substantive impacts to commercial shipping would result from use of this disposal site.

4.7.4.4 Leonard Ranch/Redwood Landfill

LEONARD RANCH REHANDLING OPTION

The 830-acre former Leonard Ranch site is owned and managed by the Sonoma Land Trust and leased for oat hay production to a local farmer. The proposed rehandling facility would result in the loss of up to 230 acres currently in agricultural production on Leonard Ranch, and the loss of an undetermined amount in the northernmost parcel ("North Marsh") which would be used for mitigation for impacts to wetlands. In 1991, 15,843 acres of hay were harvested in Sonoma County. With an average yield of 2.5 tons per acre, the total County yield was an estimated 40,256 tons. Removal of approximately 230 acres from hay production and 575 tons from the total County yield would not result in a substantial reduction in agricultural land or in hay production in the County. Potential revenue estimates from use of the site as a rehandling facility are not available.

REDWOOD LANDFILL SITE

The material transported to Redwood Landfill would be used in conjunction with the pending application of the landfill owner/operator, Redwood Landfill, Inc., for continued operation and expansion of a Class III landfill on the site. The application is under review by Marin County. The Draft EIR for the Redwood Landfill was distributed to the public for review in July 1993. The Final EIR is scheduled for certification in February 1994. Operating permits are expected to be granted after the completion of the EIR process.

4.7.4.5 Sonoma Baylands

The 830-acre former Leonard Ranch site is owned and managed by the Sonoma Land Trust and leased for oat hay production to a local farmer. The proposed use of the Sonoma Baylands site would result in the loss of about 315 acres currently in agricultural production. In 1991, 15,843 acres of hay were harvested in Sonoma County. With an average yield of 2.5 tons/acre, the total County yield was about 40,256 tons. Removal of approximately 315 acres from hay production and 800 tons from the total County yield would not result in a substantial reduction in agricultural land or in hay production in the County (also see section 5.3.5).

4.7.4.6 Galbraith Golf Course

Under this disposal option, the recreational and related commercial uses of the site would be discontinued for a period of approximately seven years. As part of the proposed plan, most of these uses would be resumed following reconstruction of the golf course near the end of this period. The Port would be responsible for any required relocation costs for any existing subtenants.

This option would result in the cessation of substantial portions of current on-site business and recreational activity for the duration of the interim construction phase. Businesses on the site include the golf course, clubhouse, restaurant, and driving range. Recreational activities on the site include golf and soccer. The Port expects to be able to continue the clubhouse, restaurant, and driving range use of the site during the interim construction phase; the other businesses and recreational activities would cease for the duration of the interim construction phase and soccer use would be diverted.

The City concessionaire of the golf course, Ransom McKay Golf, Inc., has 25 full-time and part-time employees, plus five additional full-time and part-time temporary employees during the summer months. The clubhouse restaurant and driving range, operated under sub-concession agreements from Ransom McKay, each have three employees (including the on-site owners and sponsor). Although the lease between the Port and City provides for the Port to receive substantial rent for the period July 1, 1987 through 1993, the Port has received no rent at all since July 1, 1987. The City's concessionaire owes the City over \$300,000 in unpaid contract obligations. If this disposal option is implemented, and gross sales would be reduced, and employment from the golf course operations would be eliminated during the dredged material disposal and drying phase. Other construction-related and sediment management jobs would be created, but they would likely be filled by workers other than those currently employed at the golf course. This would have an adverse impact on the employees whose jobs would be eliminated, but would have a negligible impact on the local economy as a whole. To minimize the impact on employees whose jobs would be lost, the Port would give them access to the Employment Resource Development Program (ERDP), which facilitates access of Oakland residents to jobs with Port tenants. The Port is

making an exception in this case and will allow displaced employees to use the ERDP regardless of whether they are Oakland residents. The Port has committed through a Memorandum of Understanding with the City of Oakland to rebuild a "first class" golf course at the site at its expense and lease it to the City for the long-term under substantially similar terms and conditions as the existing lease.

The City of Oakland, East Bay Municipal Utility District (EBMUD), and Ransom-McKay, Inc., have an agreement (to the year 2008) that Galbraith Golf Course will accept no less than 162 acre-feet and no more than 200 acre-feet of reclaimed water per year from EBMUD. The current price is \$0.77 per hundred cubic feet (\$335.41 per acre foot), indicating that Ransom-McKay has a basic 1994 obligation of \$54,337 for 162 acre-feet of water. If the Ransom-McKay agreement with Oakland to operate the golf course is terminated prior to July 1, 2002, the obligations of Ransom-McKay are assigned to Oakland. According to the Port-City MOU, the Port will assume all of Oakland's responsibilities under the EBMUD agreement during the period between the date that the Port takes possession of the Galbraith Golf Course through the date that the Port delivers possession of the new golf course to Oakland. The Port is currently examining the feasibility of rerouting a portion of the reclaimed water to irrigate the proposed containment berms or Port properties, such as along Airport Drive.

The project would result in the loss of 25 jobs at the golf course, many of which are held by minority or low-income persons. To minimize adverse impacts on these employees, the Port would make available to them the use of Employment Resources Development Program, which facilitates access of Oakland residents to jobs with Port tenants. In this case, employees would be allowed to use this resource regardless of whether they were Oakland residents. The project would create construction employment opportunities at the disposal site, and while it cannot be guaranteed that they would be residents of the local community, they would be hired in compliance with the Port's and Corp's Equal Opportunity/Affirmative Action requirements.

4.7.4.7 Port/Landfill

If this site is required for drying sediments that require landfill disposal, the proposed rehandling facility could affect operations of the Port's tenant, Marine Terminals Corporation, by temporarily occupying 9.2 acres necessary for the receiving, sorting and short-term storage of steel pipe and beams. However, the drying facility design will allow for continued use of limited breakbulk operation. Shipping clients may be able to be accommodated at a terminal currently not in use at the Port of Oakland. Alternatively, clients would be redirected to available berths at Richmond, San Francisco, or Alameda during the interim use period (Cathey 1993). Should business decline as a result of the temporary lack of on-site space for steel pipe and beams, the union labor used by the Marine Terminals Corporation would be redirected to other employment through the union hall.

The proposed rehandling facility is not expected to affect operations or employees of the site's subtenant, Harbor Forklift.

4.7.4.8 Montezuma Wetlands

Fees paid for use of this site would incrementally increase revenues in Solano County, which would be beneficial. No adverse economic consequences would result from use of this disposal site.

4.8 TRANSPORTATION AND CIRCULATION

4.8.1 Impact Significance Criteria

The threshold of significance used for land transportation impacts is generally the level of additional traffic that would be perceptible by the motoring public. While there is no absolute standard for this level, a change (increase) in the ratio of traffic volume to highway capacity (V/C) greater than 3 percent (0.03) was used to define a significant impact for levels of service A through D. Any increase in traffic over 1 percent to a facility that is operating at level of service E or F must be evaluated on a case-specific basis. Although there has not been rigorous research on the topic, the 0.03 threshold was chosen because it probably represents the change in traffic that is notable to most of the driving population. For example, if a signalized 4-lane street has a capacity of 1,600 vehicles per hour (vph) in each direction, an impact of 48 or more vehicles in one direction would be considered "significant" (1,600 x 0.03). Each truck is considered to be equivalent to two passenger cars for the purpose of this analysis, so in the above example, 24 or more trucks would be considered "significant." (Based on Tables 3-4 and 9-6 in the 1985 *Highway Capacity Manual*, Transportation Research Board Special Report 209, Washington, D.C.)

Waterborne transportation impacts would be considered significant if they would cause a substantial increase in: (1) unsafe vessel operations incidents, (2) the risk of toxic or polluting material entering the water, or (3) unreasonable delays to commercial vessels plying their trade. All of these potential significant impacts are a function of the combined effects of increases in waterborne traffic and other navigation hazards. Some navigation hazards are caused by natural phenomenon such as shoals and islands, fog, inclement weather, tides, and currents. Other man-made hazards include bridge abutments, piles, and moored vessels.

4.8.2 Regional

No significant regional transportation and circulation impacts are expected. The only potential regional transportation impacts would be to marine transportation because most of the associated transportation is by water (tugboats and scows). The only land transportation impacts would be associated with the Galbraith Golf Course Disposal Option, which are more localized impacts as discussed below. There would not be any slurry pipelines crossing any roads near the disposal sites.

The Coast Guard maintains a Vessel Traffic Service (VTS) Center near the top of Yerba Buena Island. Although some small and private vessels are not required to coordinate their movements by contacting the VTS, the Coast Guard monitors all commercial, Navy and private marine traffic within San Francisco Bay and local coastal waters. Coast Guard records indicate the ship traffic density has increased from about 66,000 movements in the Bay in 1981 to 90,253 in 1992 (personal communication, Staten 1993). In 1992 ferry vessel traffic represented 65 percent of the total. This is noteworthy in that ferries are highly maneuverable. They operate on regular schedules and routes and their masters are intimately familiar with the waterborne traffic on the Bay. According to Chief Primeau (VTS), ferry traffic will probably increase when high-speed ferries are introduced.

The current estimate for annual total movements on the Bay during the proposed dredging operations is 85,000 to 95,000 (personal communication, Primeau 1993). None of the alternative disposal sites

Impacts -- Transportation and Circulation

considered would involve more than 400 dredge scow round trips in a 4-month period. Thus, the reasonable, worst-case operation would result in about a 0.5 percent contribution to overall ship movements during the period of dredging operations.

Hazards to navigation for any coastal area can be divided into five categories: (1) shoals and islands, (2) bridges and other structures, (3) fog and inclement weather, (4) vessel traffic, and (5) tides and currents. A shoal area exists just west of the Golden Gate Bridge and north of the main entry channel to the Bay. This area is commonly known as the four-fathom bank or potato patch shoals and is a potential navigation hazard for any vessel with a draft greater than 24 feet.

Once inside the Golden Gate, islands and shallow areas around islands including Alcatraz, Angel Island, Treasure Island, and Yerba Buena Island are hazards to navigation and when combined with other elements such as fog, traffic or malfunctioning radar equipment, can present an extreme hazard. The traffic lanes are free of obstructions with the exception of Alcatraz Island and the Alcatraz shoals just west of the island.

The five major bridges (Golden Gate, Bay, Richmond-San Rafael, Carquinez, and Benicia) encountered when transiting the potential dredge scow routes are not hazards, provided the dredge scows stay within their designated traffic lanes. The Bay Bridge and the south tower of the Golden Gate Bridge are well-marked with buoys, flashing lights, and horns.

Meteorological conditions that make navigation in the areas difficult are primarily fog during the warmer half of the year and storms in winter. Fog occurs much of the time during the summer months, blowing in through the Golden Gate in the late afternoon and burning off during the late morning. Some types of commercial vessels, including tankers carrying hazardous materials such as fuel oil, have been restricted from transiting the Bay during periods of intense fog. Fog by itself does not pose a serious problem if ship navigation radar is in good condition, but coupled with other vessel traffic, the severe tides and currents in the Bay, and the possibility of other ships straying from the traffic lanes, navigation can be extremely difficult. In the past, serious collisions have occurred due to a combination of many circumstances, including bad weather.

Because of its unpredictability, traffic of other vessels poses perhaps the greatest hazard to navigation. Large commercial and naval vessels are required by Coast Guard regulations to travel in their designated traffic lanes when moving within inland waterways. Smaller commercial vessels, such as tug boats, ferry boats and private vessels often do not navigate within specific traffic lanes, but rather travel in the most expeditious route possible. These vessels can pose serious hazards to navigation, particularly if other circumstances such as fog are present. Private vessel traffic is heaviest during weekend days and can pose serious hazards to dredge scows under tow. Tugs frequently have trouble controlling their tows. Such incidents as towing bridles breaking and barges running aground can be found in many Coast Guard vessel traffic reports.

Tidal action causes extremely strong currents throughout the Bay Area during periods of maximum ebb and maximum flood tides. Currents above 2 knots are considered to be strong and potentially hazardous if not properly "corrected for" during slow speed maneuvering. As expected, the greatest currents occur at the Golden Gate with the average maximum flood being 3.3 knots and the maximum ebb being 4.5 knots. Strong currents also exist all along San Francisco's city front from the Golden Gate Bridge to the Bay Bridge and around Treasure Island on the east and west sides. These currents combined with the

strong winds sometimes encountered, make maneuvering large vessels at slow speed hazardous without the aid of tug assistance. Even as far south as Hunter's Point, currents of 2.2 knots exist at maximum ebb.

The VTS collects detailed reports of every vessel incident occurring in the Bay. Review of the VTS records indicates that there were 71 and 41 incidents in 1991 and 1992, respectively. The categories of incidents include the following: collisions; near-misses; vessel grounding; noncompliance (not listening to the VTS or acting contrary to their instructions); non-participation (turning the vessel radio off); hindering navigation (e.g., a sail boat passing in front of a commercial vessel); and loose barges (the tow line snaps and the barge is set adrift or the tug loses power). In 1991 and 1992 there were no incidents involving dredge vessels (either self-propelled or non-self-propelled vessels) (personal communication, Primeau 1993). In 1986, there were five incidents involving dredge vessels (either self-propelled or non-self propelled vessels). One incident was a grounding; two incidents involved loose barges; another incident was unauthorized disposal at Alcatraz; and the last was spillage of dredged material due to hydraulic problems (VTS, unpublished data, 1987). With an estimated 400 dredge scow round trips over a 4-month period, it is likely that at least one such incident will occur, but it is very unlikely that it will be serious enough to be considered significant.

If a collision did occur between one of the scows under tow and another vessel, it is difficult to predict the resulting effects because of the dependence of surrounding circumstances. Collision between a scow and a small vessel such as a tug, ferry, or private yacht would probably result in little damage to the scow, but it would result in the potential sinking of the other vessel. A small amount of fuel could be spilled in the water, and loss of life would be possible.

The results of a collision between a scow and a larger vessel could be a much more serious incident. At a minimum, damage to one or both vessels would result. A worst-case scenario would involve physical injury, death, extensive damage to both vessels, fire and spillage of a medium or large quantity of oil (over 1,000 gallons) into Bay waters. This outcome is considered extremely unlikely because scow trips and tanker trips are both a very small percentage of total movements within the Bay.

Although also a low probability, the most likely incident would be a scow running aground, or having a collision with a small private vessel. Damage would likely be confined to property loss or personal injury. Therefore, no significant impacts on vessel safety or water pollution are considered likely as a result of the dredging and disposal operation.

Several alternative disposal sites require sediments to be pumped from the scow to the ultimate disposal site. The transfer pipe can be a hazard to navigation if not properly marked and lighted.

4.8.3 Oakland Harbor

4.8.3.1 Project Impacts

No significant adverse impacts are expected on marine and land transportation in Oakland Harbor. The project would result in benefits to marine transportation, since the deeper channel would result in reduced tidal delays associated with containership passage and increased navigational safety. This would be considered a substantive benefit, as described below.

Marine Transportation

All alternative disposal options under consideration require the scow to transit the Oakland Bar Channel both outbound and inbound. This is the location where scow traffic would have the most potential for delaying the operations of large commercial vessels. If a ship and a dredge scow approach the Oakland Bay Channel from opposite directions at the same time, a 15- to 30-minute delay could result depending on the location of the vessels. Approximately 20 to 40 vessels move through the Oakland Bay Channel per day (personal communication, Primeau 1993). Vessels transit the Oakland Bar Channel about every 45 minutes on average. A dredge scow would transit the Oakland Bar Channel at a rate not greater than once every 90 minutes. This relative spacing cannot routinely cause significant delays. With both the typical commercial vessels and the dredge scow under the radio control of the Coast Guard's VTS, even the infrequent simultaneous approach of two vessels can be avoided. Therefore, the potential impact of delay and economic cost to existing commercial vessels is not expected to be significant. The actual dredging operation is a potential hazard as it restricts portions of the channel. However, these operations can and have been routinely conducted in these channels without incident and would not create a significant impact.

Land Transportation

As described in section 1.2 of this document, the number of large ships loading and unloading at the Port of Oakland potentially would increase slightly (3-7 percent) with the proposed project. The number of containers handled in a given period of time would increase due to the increase in ship calls, but also due to full utilization of the vessel's container capacity, therefore, as would the associated truck and rail activities. This section covers the impacts around the Oakland Harbor as a result of this increased activity level due to the dredging project. The impacts of the movement of dredged sediments are analyzed elsewhere in this document.

In order to address these impacts, a threshold of significance is first defined. Then the assumptions for trip generation and trip distribution used for the impact analysis are described. Before covering the project impacts and the cumulative impacts, it is necessary to have a baseline for comparison. The No-Action Alternative establishes this base from which project and cumulative impacts are addressed.

PROJECT TRIP GENERATION. The project itself would generate an increase in the number of trucks in and out of the Port. Truck trips can be separated into local truck trips and intermodal truck movements. Local truck trips are those made by trucks within the Port's hinterland, which is a distance of approximately 150-200 miles from Oakland. Local truck service usually goes no farther because other ports would be more convenient to those locations (e.g., Port of Long Beach/Los Angeles for Southern California). The intermodal truck movements are trips made to transport a container from a ship to a rail facility, or vice versa. The Port has no facilities for directly loading or unloading of rail carried containers to/from ships, so these are primarily short distance trucks operating from a ship berth to a rail yard. Although these movements would be mostly within the Port area, as noted elsewhere, movements to the Santa Fe Railway would be carried to the Point Richmond area, where its intermodal rail facility is located.

The peak day truck trip generation has been estimated at double the annual daily average. The activity levels at the Port vary dramatically according to seasonal and daily fluctuations. Typically the peak months for shipping activity are September through November, while Monday through Thursday are

typically the highest days of the week. The doubling of the annual average daily activity is intended to represent a reasonable worst-case impact on the surrounding street and highway system.

Although truck activity is not directly related to crane activity, the peak hourly activity levels are constrained by in some cases the ability of equipment to load and unload containers and the number of staffed gates. Recent surveys show that the average terminal can only process a maximum of about 24 to 35 trucks per hour (Port of Oakland 1993). This maximum constraint of 35 trucks per hour per terminal has been used in the peak hour traffic analysis.

PROJECT TRIP DISTRIBUTION. Trip distribution refers to the locations of the origins and destinations of trucks serving the Port. This will, in turn, affect the routes used by trucks. The project trip distribution has been developed from a regional survey (Port of Oakland 1991b) conducted by Caltrans in July 1991. The survey included over 1,200 trucks. Table 4.8.3.1-1 shows the origin and destination locations of truck trips from the survey.

**Table 4.8.3.1-1. Combined Origin/Destination
Locations of Truck Trips**

Other Port Terminals	6%
Oakland	26%
Other Alameda County	5%
Contra Costa County	8%
San Francisco/San Mateo Counties	10%
Santa Clara County	5%
North Bay Counties	4%
Central Valley	5%
Other California	17%
Out of State/Unknown	14%

As part of the 1991 survey, truck drivers were also asked for the routes used for their trips. These results are shown in Table 4.8.3.1-2 and in Figure 4.8.3.1-1.

**Table 4.8.3.1-2. Routes Used By Trucks Travelling
To/From Port of Oakland (1991)**

<i>Route Used</i>	<i>Inbound Percent</i>	<i>Outbound Percent</i>
Bay Bridge (I-80 west)	22.4	11.2
I-80 Eastbound	11.2	22.2
I-880	36.9	36.0
I-980	1.1	1.2
Surface streets only	28.1	29.4
Other freeway	0.3	0.0

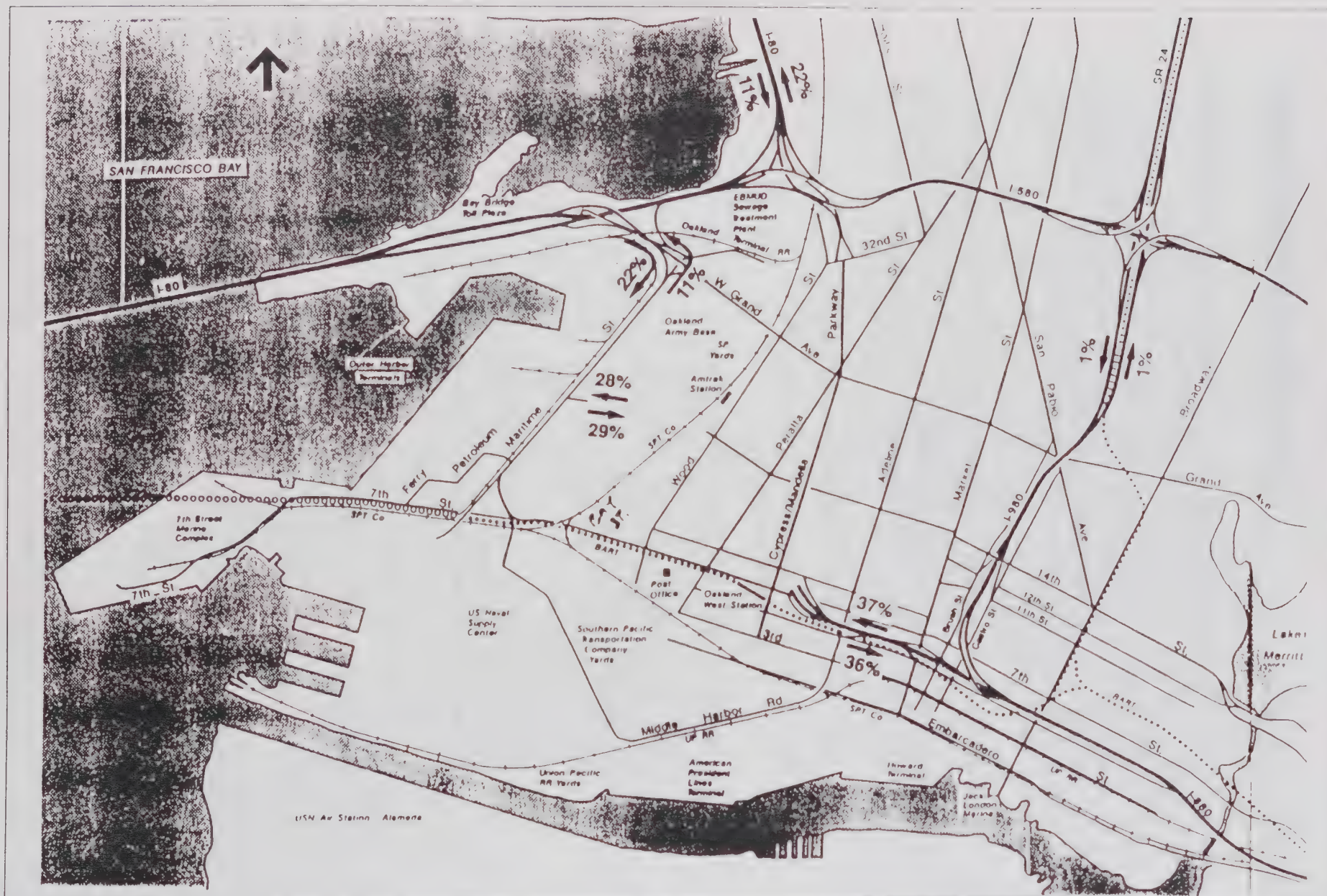


Figure 4.8.3.1-1

DISTRIBUTION OF TRUCK TRAFFIC IN OAKLAND HARBOR VICINITY (PERCENTAGE), 1991

Truck trips as a result of the proposed project are likely to be somewhat more locally oriented than present truck trips serving the Port, because a high percentage of "new" container traffic through Oakland is expected to be "intermodal." These will move only between marine and rail terminals (personal communication, Gay Joseph). However, the specific highway routes used will probably not change significantly.

IMPACTS FROM INCREASED TRUCK TRAFFIC

This section describes the impacts of the project itself assuming no change in the Port's current West Coast market share of intermodal cargo. The number of additional truck trips generated by the project for the year 2000 is shown in Table 4.8.3.1-3.

**Table 4.8.3.1-3. Additional Truck Trips Generated as a Result of the Project
in the Year 2000 (one-way trips)**

<i>Type of Movement</i>	<i>Annual Trips</i>	<i>Average Weekday</i>	<i>Peak Day¹</i>	<i>Peak Hour²</i>
Local Truck Trips 150-200 miles or less	320,489	878	1,756	
Intermodal Truck Moves (ship-rail)	39,922	109	218	
TOTAL	360,411	987	1,974	35 in/35 out

- Notes:**
1. The peak day is estimated to be double the annual average daily container loading.
 2. The peak hour generation is constrained by the loading and unloading capability of the container cranes and associated equipment and/or gate transaction capacity.

Source: Based on information in memorandum from Gay Joseph to Jody Zaitlin, "42' Dredging Impacts," dated March 11, 1993. Average weekday trips = annual trips divided by 365. There are two truck movements per container movement for local truck trips and one truck movement per container movement for intermodal truck moves.

Under the assumption that the maximum number trucks processed at a terminal is 35 per hour, the peak hour impacts of the project itself were analyzed (the actual figure varies and is up to 100 per hour at APL). The results are shown in Tables 4.8.3.1-4 and 4.8.3.1-5.

The volume-to-capacity (V/C) ratio represents the percentage of the maximum number of vehicles that can be accommodated by a facility. The capacity used for this analysis is based on ideal conditions on a basic freeway, assuming 2,000 vehicles per lane per hour.

The V/C ratio corresponds to specific service levels which are qualitative measure of traffic conditions. Typically, the level of service (LOS) standard for signalized intersections is "C" or "D," which correspond to a V/C of less than 0.77 for LOS "C" and a V/C of less than 0.83 for LOS "D" based on design speed for a basic freeway section. Generally, level of service "A" describes free flow conditions where vehicles are almost completely unimpeded by other vehicles, while level of service "E" describes operating conditions at or near capacity. Levels of service "C" and "D" describe stable flow at various vehicle densities.

Table 4.8.3.1-4. Results of Impact Analysis for the Project for the Year 2000

Link	Capacity/hr	----- NO PROJECT -----				----- PROJECT -----				----- CHANGE -----				Significant?
		-----		-----		-----		-----		-----		-----		
		Vol/Hr		V/C		Vol/Hr		V/C		Vol/Hr		V/C		
		A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	
Bay Bridge (I-80)	10,000	11,036	11,828	1.10	1.18	11,044	11,743	1.10	1.18	8	15	0.00	0.00	No
I-80 - southwest of Powell	10,000	10,532	9,108	1.05	0.91	10,540	9,123	1.05	0.91	8	15	0.00	0.00	No
I-880 - south of 7th Street	6,000	4,197	4,023	0.70	0.67	4,223	4,048	0.70	0.67	26	25	0.00	0.00	No
I-980 - San Pablo Ave. OC ¹	10,000	6,432	7,665	0.64	0.77	6,433	7,666	0.64	0.77	1	1	0.00	0.00	No

Notes: 1. OC = Overcrossing.
A.M. and P.M. volumes reflect flow in the peak direction only.

Table 4.8.3.1-5. Level of Service Results for the Year 2000

<u>Link</u>	<u>LEVEL OF SERVICE (LOS)</u>						<u>Significant?</u>
	<i>No Project</i>		<i>Project</i>		<i>Change</i>		
	<u>A.M.</u>	<u>P.M.</u>	<u>A.M.</u>	<u>P.M.</u>	<u>A.M.</u>	<u>P.M.</u>	
Bay Bridge (I-80 W)	F	F	F	F	--	--	No
I-80 E - southwest of Powell	F	D	F	D	--	--	No
I-880 - south of 7th Street	C	C	C	C	--	--	No
I-980	C	D	C	D	--	--	No

Based on the current distribution, the surface streets will see an increase in truck traffic equivalent to about 20 passenger cars during the peak hour, which would not increase existing V/C ratios more than 0.03; therefore, the project would not create a significant impact.

IMPACTS ON LOCAL STREETS AND FREEWAY RAMPS/INTERSECTIONS. The impacts on local streets for the year 2000 are shown in Table 4.8.3.1-6.

Table 4.8.3.1-6. Project and Cumulative Impacts on Local Streets

(First figure is southbound movement/second figure is northbound, in levels of service and in vehicles per hour. Passenger car equivalents; assumes Cypress Replacement completed.)

		<u>Maritime Street</u>	<u>7th Street</u>	<u>Middle Harbor</u>
Existing Level of Service	A.M.	B/A	A/A	B/A
	P.M.	B/B	B/B	A/A
With Project Increment	A.M.	B/A	A/A	B/A
	P.M.	B/B	B/B	A/A
Existing Peak Volume (1993)	A.M.	1,408 / 335	179 / 933	670 / 80
	P.M.	542 / 1,476	773 / 521	220 / 609
Project Increment	A.M.	23 / 23	23 / 23	6 / 6
	P.M.	23 / 23	23 / 23	6 / 6
Traffic Increment Constituting a Significant Increase		58/58	48/48	24/24
Project Increment Significant? (> 3% of capacity)		N / N	N / N	N / N
Cumulative Increment	A.M.	46 / 46	46 / 46	12 / 12
	P.M.	46 / 46	46 / 46	12 / 12
Cumulative Increment Significant?		N / N	N / N	N / N
		N / N	N / N	N / N

While there is no formal standard for what constitutes a significant traffic impact, a 3 percent change in the V/C ratio is a threshold likely to be noticeable to motorists driving on a street. The surface street capacity in this analysis is 800 vehicles per hour, per lane. A 20 percent increase in capacity is provided where a center turn lane is provided, as on Maritime Street.

Impacts – Transportation and Circulation

Cumulative traffic includes the effects of new land use development estimated by Alameda County cities to occur by the year 2000. See section 10.2.9 for further information. The table above shows that both the project and cumulative impacts of Port expansion itself do not represent significant traffic impacts. In part this is because the Cypress replacement project will remove trucks from many surface streets. Table 4.8.3.1-7 shows the impacts of the additional truck traffic on nearby freeway ramps and the associated surface street intersections with these ramps. The table shows that the project alternative would not change any of the traffic service levels at any of the intersections.

Table 4.8.3.1-7. Freeway Ramp Conditions for the Year 2000

<u>Location</u>	<u>1990/1991</u>		<u>LOS</u>	<u>Increment</u>	<u>With Project</u>	
	<u>Peak</u> ^(a)	<u>Hour</u>			<u>V/C</u> ^(c)	<u>LOS</u>
I-880 NB off at 6th and Market	652 A.M.	0.43	A	13	0.43	A
	408 P.M.	0.27	A	13	0.28	A
I-880 SB on at 5th and Adeline	192 A.M.	0.13	A	13	0.14	A
	546 P.M.	0.36	A	13	0.37	A
I-880 NB off at 8th and Mandela	987 A.M.	0.66	B	13	0.67	B
	620 P.M.	0.41	A	13	0.42	A
I-880 SB on at 7th and Mandela	570 A.M.	0.38	A	13	0.38	A
	976 P.M.	0.65	B	13	0.65	B
I-80 EB/EB off at Maritime and W. Grand	837 A.M.	0.56	A	23	0.57	A
	444 P.M.	0.30	A	23	0.31	A
I-80 EB/WB on at Maritime and W. Grand	321 A.M.	0.21	A	23	0.23	A
	1,178 P.M.	0.79	C/D	23	0.80	C/D
I-980 WB off at 12th and Brush	2,139 A.M.	1.43	E	1	1.43	E
	1,224 P.M.	0.82	D	1	0.82	D
I-980 EB on at 11th and Castro	135 A.M.	0.09	A	1	0.09	A
	133 P.M.	0.09	A	1	0.09	A

Notes: Traffic data for the cumulative scenario were not available from the Alameda County Traffic Model.

(a) Based on upper range (highest) count in 1990 (by Korve Engineering).

(b) Volume to capacity ratio.

(c) Assumes capacity at LOS E is 1,500 VPH per lane, V/C is total with project.

All of the V/C changes due to the project would be 0.02 or less, which is below the defined threshold of significance. The largest increase impact would occur at the I-80 eastbound/westbound on-ramps at Maritime Street in the A.M. peak. These ramps provide access to both the Bay Bridge and I-80 east traffic, so they are heavily utilized. The cumulative impacts (Year 2000) could not be estimated because the future freeway ramps volume projections were not available. Some volumes would undoubtedly drop as a result of the completion and opening of the Cypress structure replacement project, which is anticipated to be open by the year 2000.

The peak day, as before, has been estimated by taking the annual average (assuming 365 days per year) and doubling it. The added rail crossing time has been computed using the train speed on the southern Embarcadero section. For the unmitigated situation, the existing speed (10 mph, or 14.7 feet/second)

has been used. The mitigated alternative assumes that the train speeds have been increased to 20 mph (29.3 feet/second). This increase in train speed would be the result of signalling and street improvements being proposed for this area as part of the Oakland Amtrak station relocation. The table assumes that containers are carried on 305-foot, double-stack cars that can accommodate 20 TEUs per car, and that 65 percent of all the freight travels on the southern Embarcadero. The southern Embarcadero has been the focus for this analysis, since it is where trains travel most slowly, and where the concentration of impacts would be greatest. Without the project, the actual *number* of trains operating is not likely to change from current 1993 levels; trains would most likely be shortened without the project, or lengthened under the proposed project to accommodate the change in demand. The cumulative scenario, however, would probably result in an additional three trains per day, or about 26 per week, being run to meet the increased demand.

The project is not expected to increase employment at the Port itself, but the tenant's labor force would increase. However, there could be secondary impacts on increased employment in the surrounding area (e.g., the employment of trucking, warehousing, import/export, and related firms could increase as a result of the project). The transportation impacts of such an employment increased are likely to be widely diffused throughout the central Bay Area, and would not have a significant transportation impact.

IMPACTS FROM INCREASED RAIL TRAFFIC. Changes in the container volumes handled by the Port would also affect rail traffic into and out of the Port. The estimates on the annual change in the number of container units have been based upon information supplied by the Port (1993b). This information, along with estimates of changes in crossing delays, is shown in Table 4.8.3.1-8. Negative values (i.e., reductions) are shown in parentheses.

Table 4.8.3.1-8. Impacts of Additional Rail Traffic for the Year 2000

	<u>No Action</u>	<u>With Project</u>	<u>Cumulative^(b)</u>
Annual TEU Change ^(a)	-112,818	39,922	270,820
Peak Day Change (TEUs)	-618	219	-1,483
Change in Train Length (feet) @ 15.25'/TEU ^(c)	-9,425'	3,340'	22,616'
<u>Additional Rail Crossing Delay^(d)</u>			
Unmitigated	-7.0	2.5	16.6
Mitigated	-3.5	1.3	8.3

Notes: (a) TEU = 20-foot equivalent unit (e.g., a 40-foot container = 2 TEUs).
 (b) Cumulative activity is based on the "high activity" estimates by the Port of Oakland (1993b).
 (c) This is a conversion value to account for container stacking.
 (d) Crossing delay is expressed in minutes per crossing per day.

The significance of this impact depends on the time of day that the trains are scheduled. For example, an additional train at 3 or 4 A.M. would not have a significant impact on delays to traffic (and pedestrians); an additional train at 4 P.M. would. Because significant empty capacity exists on rail movements from the Port outbound (eastbound), it is likely that the additional intermodal containers by

Impacts – Transportation and Circulation

1 rail would not require increasing the existing train lengths. Furthermore, typical railroad scheduling
2 practice is to run long distance trains from the west coast during the night, when they would have a lesser
3 impact on vehicular traffic. Therefore, the changes due to the No-Action Alternative, the Project
4 Alternative, and the Cumulative Alternative are all considered not significant (neutral) with respect to rail
5 impacts on the environment and safety.

6 7 **4.8.3.2 Mitigation Measures**

8 9 ***Marine Transportation***

10
11 Although no significant impacts on marine transportation are expected, the U.S. Coast Guard has
12 recommended that the following measures be observed during dredging operations:

- 13
14 • All vessels associated with the project and operating in or near a navigation channel shall
15 monitor VHF-FM Channel 13.
- 16
17 • In the event project vessels are likely to restrict or affect navigation of other vessels,
18 vessel operators shall transmit and confirm their intentions and any other necessary
19 information via Channel 13 to promote safe navigation of all vessels in the project
20 vicinity.
- 21
22 • U.S. Coast Guard VTS shall be contacted each time: (1) a vessel moves a scow between
23 the dredge and disposal sites; (2) when the dredge plant commences dredging operations;
24 and (3) when the dredge operators change dredge location. Upon notification, VTS shall
25 advise affected shipping traffic.
- 26
27 • Once the dredge is positioned, VTS shall be informed of the extent of any channel
28 obstruction that may occur from dredging operations. Because the numbers and types
29 of dredging vessel equipment associated with the proposed project are not anticipated to
30 block the channels of operation, other shipping traffic is not expected to be blocked from
31 normal vessel movements. In any event, VTS shall be informed of positions of dredging
32 equipment at all times.

33 34 ***Land Transportation***

35
36 Since no significant impacts from project truck traffic have been identified from the project, no mitigation
37 measures are proposed. The traffic in the Oakland Harbor tends to disperse rapidly to the freeway system
38 due to the proximity of several freeways. The operations at the terminal restrict the number of trucks
39 that can be processed during the peak hour, thus limiting the throughput for container flow and
40 distributing it over the day.

4.8.4 Disposal Site Options

4.8.4.1 Ocean Section 102

Project Impacts

No significant transportation impacts are expected. This site is located outside of designated commercial vessel traffic lanes and away from any restricted passage areas, precautionary zones, or anchorages for commercial shipping. Project tugboats would represent additional vessel traffic within the project area. However, in relation to the volume of traffic in the San Francisco Bay area, the increase would be minor, and no significant impacts would occur. (Refer also to the discussion in section 4.8.2.)

Mitigation Measures

No mitigation measures are required.

4.8.4.2 Alcatraz

Project Impacts

No significant transportation impacts are expected to occur if this disposal site is used. This site is located within a shipping lane between San Francisco and Alcatraz Island, an area used by ships accessing marine terminals and ports in San Francisco and the central and south San Francisco bays.

Scows would be towed by tugboat to the Alcatraz site, positioned, and dumped. The tug/scow combinations would travel a total distance of approximately 6 nautical miles each way. The dredge scow path for this site involves crossing traffic lanes just east of Alcatraz on the outbound leg and south of the Bay Bridge on the inbound leg. These are relatively high risk maneuvers, but well established ones for the masters of the tugboats and scows. Additionally, this site has been used for many years, so that dredge disposal activities are known and expected. After previous dredged sediment disposal at this site, some shoaling has occurred, but this has not caused any significant impacts to navigation. (Refer also to the discussion in section 4.8.2.)

Mitigation Measures

No mitigation measures are required.

4.8.4.3 Bay Farm Borrow Area

Project Impacts

This site is not located within any major shipping channels, and impacts would be insignificant (PTI 1989). (Refer also to the discussion in section 4.8.2.)

Mitigation Measures

No mitigation measures are required.

4.8.4.4 Leonard Ranch/Redwood Landfill

Project Impacts

No significant marine transportation impacts are expected due to use of the Leonard Ranch/Redwood Landfill site. Trucking dredged material to the Redwood Landfill would increase risk of accidents and congestion.

MARINE TRANSPORTATION

The dredged material would be transported to the Leonard Ranch site by 3,000-cy-capacity scows towed by tugs. The tugs would use navigable channels through San Pablo Bay to deliver sediments to a point in the mouth of the Petaluma River, approximately 3,000 feet south of Port Sonoma-Marin. There, an offloading facility would be constructed just east of the navigable river channel. Access from the San Pablo Bay to the offloading facility is via the federally maintained Petaluma River - Across the Flats Channel. This channel is maintained to a depth of -8 feet MLLW and has a width of 200 feet from San Pablo Bay to the offloading facility. Using partially loaded 3,000-cy scows and avoiding low tide conditions would allow access to the offloading facility without requiring dredging the river bottom.

The distance from the dredging area to the offloading facility would be approximately 16 miles. Transportation of the materials would require an estimated 400 to 450 round trips, comprising a 4-month material hauling period, and would add three or four scow trips per day to the existing traffic along the path from the Oakland Bar Channel to the main channel of the Petaluma River. Such an increase would have an insignificant impact on the safety of vessel operations, because it is consistent with established movements, according to the U.S. Coast Guard.

In addition to Port Sonoma-Marin, various other marinas and commercial and industrial docks are located upriver as far as Petaluma. Navigation traffic in the Petaluma River is extremely light and consists primarily of pleasure crafts such as motor and sailing yachts and small fishing boats; however, commercial fishing vessels and small- to medium-sized tugs and barges do transit the area infrequently. The offloading facility is located in a naturally wide and deep area and should not adversely affect local navigation. The facility will require special coordination with the U.S. Coast Guard for required navigation warning lights and published warnings in the Local Notice to Mariners.

The offloading facility would have adequate capacity to handle full scows waiting to be unloaded and empty scows waiting to be tugged back to the dredge and would be configured to not adversely affect navigation of the channel.

LAND TRANSPORTATION

The project has the potential to generate up to 1.5 million cy of dredged materials (sediments), to be dried at the Leonard Ranch site. Once dried, the project sponsor proposes to transport the material to the Redwood Landfill, which would make use of the material for purposes described elsewhere in this document. The first year of transport drying would have no impacts on the highway system, because the material would be moved to Leonard Ranch by barge and pipeline, and because up to 4 years are required (depending on climatic conditions, volume of material, and extent of material handling) for the material to dry. Some of the material could be dry enough to transport after one year.

After the first year, the project would increase the number of trucks on U.S. 101 and SR 37 in Marin and Sonoma counties. The dried dredged sediment would then be transported via truck from Leonard Ranch to Redwood Landfill, a direct distance of approximately 17 miles. To minimize some traffic impacts, a specific route for the trucks is proposed. The trucks would exit Leonard Ranch by turning left at the signal at the intersection of Reclamation Road-Lakeville Highway and SR 37, follow SR 37 to U.S. 101, and turn into the Redwood Landfill. On the return trip, trucks would exit Redwood Landfill making a right turn onto U.S. 101 (rather than a left turn), proceed north on U.S. 101 a distance of approximately 5 miles, exit at the South Petaluma interchange (Petaluma Boulevard South), proceed to the existing overcrossing of the U.S. 101 freeway, and re-enter the freeway southbound at the South Petaluma Boulevard on-ramp. Thus, the northbound (loaded) trip would be approximately 12 miles, and the return (empty backhaul) trip would be 22 miles. The total round trip would be approximately 34 miles.

The round-trip time for a truck to make a complete circuit, including loading and unloading, would be one hour. They also estimate that trucks could be dispatched every five minutes. The relationship between the number of trucks (V) in operation, the total "circuit" time (C), and the time between truck departures (H) is expressed by the formula:

$$V = C / H$$

In this particular case, C = 60 minutes and H = 5 minutes, so the number of vehicles required to operate this service would be 12 trucks, which is probably a reasonable number given the quantities of material to be moved. Each truck can carry between 10 and 20 cy of material; a mid-range value of 15 cy per truckload has been used in this analysis (Gahagan & Bryant Associates 1993). The possibility of using larger trucks is considered as a project mitigation.

The hours of operation of trucks would be scheduled to avoid peak hours on U.S. 101 and SR 37. The peak traffic hours are from about 6:30 to 8:30 A.M. and 4 to 6 P.M. Operations would begin at 5 A.M. (or even earlier), then suspending operations during the peak traffic hours. Operations would cease by 3 P.M., providing for eight productive hours of work and permitting 96 truckloads of material, or about 1,440 cy, of material to be moved per day. At this rate, it would take approximately 1,050 working days, or 4.2 years, to move 1.5 million cy of material.

Threshold of Significance. A change (increase) in the ratio of V/C greater than 3 percent (0.03) has been used in this study to define a significant impact. A significant accident impact is defined as when the expected number of injury accidents as a result of the project is one or more. Each truck is considered to be equivalent to two passenger cars for the purpose of this analysis.

Project impacts are likely to occur at these locations:

- At the entry/exit of Redwood Sanitary Landfill at Sanitary Landfill Road, in Marin County.
- On the U.S. 101 freeway on- and off-ramps in Petaluma.
- On the mainline portions of U.S. 101 and SR 37.

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- At the signal at the intersection of SR 37 and Reclamation Road-Lakeville Highway.

Because traffic growth unrelated to this project is occurring at all of these locations, it was necessary to make an assumption about the year in which these traffic impacts would occur. For purposes of this study, 1997 has been chosen as the analysis year; however, the results of the impact analysis are not sensitive to the choice of impact years, provided that the actual year is within a year or two of 1997.

Landfill Road and U.S. 101. Currently, between 35 and 55 vehicles per hour are entering the site. The project would add approximately 12 vehicles per hour. The background (non-project) traffic is expected to increase somewhat in the future. The intersection currently operates at LOS "F" during peak hours for the traffic making the left turn out of the site. This indicates relatively long waits for vehicles exiting the site, including those wishing to turn right (northbound) out of the Sanitary Landfill Road. Inbound traffic northbound on U.S. 101 can use a shoulder area for deceleration to make the right turn into the site, but this poses primarily a minor inconvenience for other traffic.

Traffic accident potentials are difficult to estimate, because they are probabilities rather than definite impacts. A significant impact of the project-generated truck traffic would likely be increased accident potential at the intersection. The project would increase the traffic into and out of the Landfill Road by approximately 30 percent (Abrams and Associates 1992). Based upon the accident information provided by Abrams, the last 3.5 years have averaged 0.86 fatalities and 6.9 injury accidents at this intersection. Many of these accidents resulted from vehicles turning left out of the site, a movement that would not be increased by the project. Assuming a 30 percent increase in accidents (the same as the increase in traffic on Sanitary Landfill Road), which would provide a worst-case analysis, the expected number of accidents over the 4.2-year duration of the sediment transportation would be 1.08 fatalities and 8.6 injury accidents. This is considered a significant impact.

U.S. 101 Freeway Ramps in South Petaluma. The maximum impact at these ramps would be during the hour ending at 9 A.M. Based on counts by Caltrans (March 1992), the traffic entering Highway 101 is approximately 720 vph; exiting traffic is 200 vph. Using a truck to passenger car equivalent of 2, the project would add 24 passenger-car equivalents per hour to each of these ramps. This increment is about 2 percent of the ramp's capacity. While such increase is likely to be noticeable to many drivers, it is not significant in terms of traffic congestion.

U.S. 101 and SR 37 Mainline. Using a fairly conservative capacity of 1,200 vph for the expressway segments of U.S. 101 and SR 37, the project-related increase in trucks would represent an increase of 0.01 in the V/C ratio of the affected segments. This is not a significant impact.

State Route 37 and Lakeville Highway. Traffic counts were performed at this intersection from 7 to 9 A.M. Assuming that sediment transportation is suspended from 6 to 10 A.M., this analysis represents a worst-case analysis. Based on the volumes during the 7 to 9 A.M. period, the V/C at this intersection is 0.80, which is equivalent to LOS "C/D" (Method: Transportation Research Board *Circular 212 Planning Method*, 1980). The addition of 12 trucks per hour to and from Reclamation Road is not expected to have a significant impact on congestion and delay at this intersection, because the truck movements overlap with other traffic movements that determine signal timing at this intersection. There is no expected change in the V/C ratio or LOS, although eastbound traffic in the right lane may experience minor delays when trucks slow to make the right turn into Reclamation Road. Some increase

in the expected number of accidents at this intersection would also occur, although the presence of a signal at this intersection tends to reduce the potential for accidents here. This is not a significant impact.

Truck traffic impacts from importing approximately 4.5 mcy of material from various sources to Redwood Landfill for construction of a perimeter levee, clay liners, interim cover and final cover, have also been addressed in the *Redwood Sanitary Landfill Final EIR* prepared by Marin County Planning Department (Woodward-Clyde Consultants 1994). That analysis includes transportation of dried Oakland harbor sediments as one potential source of material. Marin County estimates that during peak construction activities at the landfill, up to 200 daily truck loads of material would be required to import the construction soil material. This traffic increase would be a significant traffic impact. Marin County recommends that operation of trucks importing construction material be restricted to the hours of 3 to 6 A.M. and 10 to 3 P.M. to avoid conflicts with peak hour traffic movement at the U.S. 101/Sanitary Landfill Road intersection. The *Redwood Sanitary Landfill Final EIR* is incorporated here by reference.

Mitigation Measures

MARINE TRANSPORTATION

Traffic associated with this alternative disposal site would not make a significant impact on vessel maneuvering safety; however, the relatively minor impacts of dredging operations should be mitigated to the extent possible. Proposed measures include the following:

- The Corps of Engineers' Engineering and Construction personnel shall require the dredging contractor to use equipment that is appropriate to the project and properly maintained. Many navigation incidents with dredge scows involve parted towing bridles that lead to "runaway scows." Very often the proximate cause of these incidents is improper or inadequately maintained equipment.
- The dredging contractor shall be required to prepare, submit, and adhere to a dredging operations plan. This plan shall identify the specific equipment to be used, the sequence of operations, the precise path of the scows, and contingency plans to deal with inclement weather and other natural phenomenon described in this report.
- Tug/scow operators shall be required to be licensed masters. Tug/scows operations are inherently more difficult than vessel operations, and maneuverability is quite limited. In view of the inherent risk to other vessels, the competent tug/scow master is the key to safe operations.
- Tug/scow operations shall be confined to marked navigation channels to the maximum extent possible. These channels are intended specifically for large, less maneuverable vessels; smaller vessels can and should stay away from these channels. Because operations within the channels are restricted, tug/scow maneuvers will be made among like vessels with experienced licensed masters.
- The U.S. Coast Guard publishes specific "rules of the nautical road," which govern dredging operations in inland waterways. Specific markings and lighting of dredging equipment allow mariners to readily recognize the operations and take appropriate

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maneuvering actions. These specific rules for marking equipment apply to the dredge site and the transfer pipes associated with the proposed project. The dredging contractor shall be required to adhere to these requirements. The U.S. Coast Guard routinely enforces their regulations.

All of these measures plus those related to dredging (see section 4.8.3.2), when applied together, will reduce the potential impact on vessel maneuvering safety to the lowest possible level.

LAND TRANSPORTATION

The Port has proposed the following:

- Trucking of material from Leonard Ranch to Redwood Landfill will be limited to the hours between 3 A.M. and 6 A.M. and 10 A.M. and 3 P.M. as recommended by Marin County in the *Redwood Sanitary Landfill Final EIR*. Marin County has concluded that implementation of this mitigation measure will reduce traffic impacts to a less than significant level (Woodward-Clyde Consultants 1994).

4.8.4.5 Sonoma Baylands

Project Impacts

MARINE TRANSPORTATION

Marine transportation associated with disposal at the Sonoma Baylands site would be the same as described for the Leonard Ranch site in section 4.8.4.4. No significant marine transportation impacts are expected.

Land Transportation

There would be no impact on land-based transportation from this option as there would be no ground transportation under the Sonoma Baylands disposal alternative.

4.8.4.6 Galbraith Golf Course

Project Impacts

No significant transportation impacts are anticipated from use of the Galbraith Golf Course site.

Transport of dredged sediments from the Oakland Harbor to the disposal site would be via tug-pushed scows and pipeline from either San Leandro Bay (Option A) or San Francisco Bay (Option B) as discussed in section 3.8.2.6. Because of the shallow waters near the San Leandro shoreline, the tug-drawn scows could only navigate within approximately 3 miles of the drying pond site. An offloading station would be constructed in the Bay to allow unloading of the sediments via hydraulic pipeline floating on the Bay.

1 The pipeline and the offloading station would be properly marked and lighted to prevent navigational
2 hazards to watercraft using the area. The pipeline would not cross the access channel to the San Leandro
3 Marina. Segments of the pipeline could be submerged to allow small boat traffic to cross over. The
4 pipeline route would be designed to not intersect boat traffic.
5

6 This use of this site would require the sediment to be pumped via pipeline from the offloading station to
7 the golf course. The offloading station site and the pipeline would be properly and clearly marked,
8 lighted, and secured to minimize conflicts and hazards with recreational use and navigation of the affected
9 areas.
10

11 There would not be any land transportation impacts from the transfer of sediment from the dredged
12 material scows to the site. However, there would be truck traffic generated by the transport of levee
13 material to the site, along with cover material (topsoil). It is expected that 228,000 cy of levee material
14 would need to be imported to the Galbraith site in 1994-95. It is assumed that all of this material would
15 be trucked to the site from commercial sources in the region, although a portion of this material may
16 come from on-site sources. The Port's stockpiles are centered around Pardee Avenue, located
17 approximately one-half mile north of the site and about one mile by road. For the purposes of this
18 analysis, it was assumed that all of the material would have to be trucked in from distant sources,
19 representing the worst-case condition.
20

21 Principal truck access is most likely to be from the Davis Street/San Leandro interchange, since this is
22 closest to the site entrance. It is possible that trucks may also use Hegenberger or 98th Avenue when
23 travelling to/from a site to the north, but these are probably not the truck drivers' preferred routes, at
24 least when I-880 is not congested in this area (which it generally is not). Using 14-cy capacity trucks
25 filled with about 12 cy of material, approximately 19,000 round trips would be generated. Assuming a
26 hauling period of 4 months, 6 days per week, and 9 hours per day, approximately 185 round trips per
27 day, or about 20 round trips per hour would be required to transport the 228,000 cy of material to the
28 site.
29

30 Existing and future traffic volumes have been assigned to the appropriate routes (Table 4.8.4.6-1). As
31 before, a truck has been treated as equivalent to two passenger cars for level of service analysis. In that
32 case, if all trucks used the Davis Street/Doolittle Drive route to the site, the traffic impact would not be
33 significant. The 370 daily one-way trips added to this street (weighted by two) represent less than a 0.03
34 increase in traffic to the 26,500 vehicles currently using this street or to the 33,400 capacity of this street.
35 The traffic impact would even be less if other routes (Hegenberger and/or 98th Avenue) were used in
36 addition, although this is not recommended because both of them have poorer levels of service at present,
37 more frequent signals, and greater pedestrian activity levels. In addition, 98th Avenue has some nearby
38 residential uses that could be negatively affected by truck noise.
39

40 Topsoil will be trucked to the site after the sediment is dry to be used as ground cover. Assuming 12
41 cy per truck, shipping 320,000 cy over 6 months, 6 days per week, and 9 hours per day, approximately
42 171 round trips per day or about 19 round trips per hour would be generated. This activity would occur
43 *after* (not during) the import of the levee material. Again, this volume of trucks would represent less
44 than a 0.03 increment to traffic along Davis Street/Doolittle Drive in this area. Topsoil would be placed
45 during the year 2000. As noted above, Hegenberger Drive should not be impacted by this activity, since
46 it would not be the shortest route to the site from I-880, regardless of whether trucks are coming from

the north or south. Future increases in traffic (due to Oakland Airport growth and other development in the area) are likely to make Hegenberger even less relatively attractive in the future than it is today.

Table 4.8.4.6-1. Traffic Analysis of Route 61 (Doolittle-Davis Street) Near Club House Entrance for an Average Weekday

Existing Traffic Volume	26,500
Capacity	33,400
Volume/Capacity Ratio (LOS)	0.79 (C)
Existing Traffic + Levee Material Movement	26,685
Volume/Capacity Ratio (LOS)	0.80 (C)
Year 2000	
No Project Daily Volume ¹	33,500
No Project Daily Volume/Capacity (LOS)	1.00 (E)
With Project Daily Volume	33,671
With Project Volume/Capacity (LOS)	1.00 (E)

Note: 1. Year 2000 No-Project traffic from Alameda County Traffic Model P.M. peak traffic projection, and using a 10.9 percent P.M. peak/daily ratio (taken from Caltrans *Traffic Volumes*).

Mitigation Measures

No significant roadway impacts from the use of the Galbraith site are anticipated; therefore, no mitigation measures are required.

4.8.4.7 Port/Landfill

Project Impacts

No significant transportation impacts have been identified as a result of this disposal option.

If this site is required for drying sediments that require landfill disposal, a portion of the Ninth Avenue Marine Terminal would be used to dry material dredged from the project. The material would be removed from the Oakland Harbor with a clamshell dredge and placed on a barge, which will be transported to the Ninth Avenue Terminal, located near the Embarcadero and Ninth Avenue, west of the I-880 freeway. The material would be handled with a clamshell-type rig directly from the barge onto the site. Evaporative drying would take 2 to 3 months for each cycle of 3 feet of material. Material would then be loaded onto trucks or rail cars for transportation to the ultimate disposal site.

The total number of truck trips generated depends on the quantity of material to be moved, although the rate of movement would be no more than 96,000 cy in 3 months. Using a capacity of 13 cy per truck, this would require 7,385 truck trips, or approximately 96 round trips per working day with 6 working days per week during months of sediment transport.

WEST CONTRA COSTA SANITARY LANDFILL (RICHMOND SANITARY SERVICE). The route for loaded trucks would be from the Ninth Avenue Terminal, onto I-880 and I-980 via the 5th/10th Avenue interchange. If the Cypress Replacement Project is completed prior to project commencement (scheduled for late 1997), trucks could use this freeway rather than the more congested I-980. Trucks would use I-80 to I-580 in Richmond, exiting at Castro Street. They would proceed north on Castro Street to the North Richmond Parkway, then west on Parr Boulevard to the landfill. The one-way driving time is between 30 and 50 minutes, depending on the time of day and traffic conditions.

The expected number of truck trips per day (96 round trips or 192 one-way trips assuming three drying cycles) is expected to be an insignificant addition to the traffic volumes along any of the routes used. On I-80, for example, the maximum percentage increase in traffic would occur in Albany at the I-80/I-580 branch, where the increment of increase would be just over 0.09 percent of the total traffic volume. Relative increments on surface streets would be somewhat larger, although the streets are established truck routes where the incremental impact of 192 daily one-way truck trips is likely to be small in relation to total traffic. Traffic volume fluctuations on many freeways and most streets are at least 10 percent from day-to-day, so such changes are not likely to be noticed.

BFI VASCO ROAD SANITARY LANDFILL. Southbound on-ramps are located near the Ninth Avenue terminal (at 10th Avenue). From there, trucks would head south to I-880, east on I-238 to I-580, and east on I-580 to the Vasco Road exit. From there, it is approximately 2.5 miles north on Vasco Road to the landfill site. The return trip would use the same route, with empty trucks exiting I-880 at the 5th/10th Avenue connections. One-way driving time is approximately 45 to 65 minutes, depending upon the time of day and traffic conditions.

The expected number of truck trips per day (96 round trips or 192 one-way trips) is expected to make an insignificant addition to the traffic volumes along any of the routes used. On I-880, for example, the traffic increment would be 0.09 percent of the total traffic volume. On I-238, the increment would be 0.18 percent of the total volume. Given that the day-to-day fluctuations in traffic volume are on the order of 10 percent, such changes are not likely to be noticed.

RAIL LINE TO EAST CARBON, UTAH. Traffic impacts of this alternative would be largely confined to the Port area, with direct loading of dredged materials onto rail cars at the Ninth Avenue Terminal. Assuming about 75 cy per rail car and 60 cars per train, the movement of 96,000 cy of material per year would generate about 1,280 carloads, or 21 to 22 trains. These cars would be made into special trains. Assuming movements over 3 months, this would require dispatching 3 or 4 times per month. The precise impact would depend upon the time of day trains are dispatched, which is not known. However, given the relatively infrequent train movements it is likely to have insignificant impacts on rail/highway grade crossings delay to vehicles.

Mitigation Measures

No mitigations are required, because no significant impacts have been identified for this disposal option.

4.8.4.8 Montezuma Wetlands

Project Impacts

No significant transportation impacts are expected to result from use of the Montezuma Wetlands site. It is anticipated that few, if any, vehicle trips would be generated by selection of this disposal site, since dredged materials would be placed in scows and towed to the site through Carquinez Straits. Dredged material would be off-loaded on the south end of the site across from Chain Island. The scows would be moored perpendicular to the shoreline on the Sacramento River and the dredged material would be piped to the disposal site. It would be anchored in place by two 100-foot-long by 50-foot-wide "working barges," which would also be moored in the river. Recreational use of the Sacramento River is light, and no significant conflicts between project vessels and recreational vessels are anticipated. Project traffic would be only a small increment of the total vessel traffic associated with operation of this disposal site, and impacts to navigation are not considered significant (Solano County 1993).

Mitigation Measures

No mitigation measures are required; however, the measures identified in section 4.8.4.4 should be implemented to minimize impacts to navigation.

4.9 HUMAN HEALTH RISK ASSESSMENT

This section briefly summarizes the methodology and the results of quantitative human health risk assessments (HHRAs) for the Leonard Ranch Rehandling Site, the Galbraith Golf Course, and the Ninth Avenue Marine Terminal. A complete discussion of these HHRAs may be found in the Draft Human Health Risk Assessment for the Leonard Ranch Rehandling Site, Galbraith Golf Course, and Ninth Avenue Terminal (HLA 1994a), which is incorporated into this document, by reference. The complete Human Health Risk Assessment is available for review at the Port Environmental Department.

4.9.1 Impact Assessment Methodology

An HHRA for three of the potential upland disposal sites was prepared to estimate potential health risks associated with the proposed placement of dredged sediment at the sites. These HHRAs were based on chemical analyses performed on samples of sediment to be dredged. The samples were collected by Battelle (1988, 1990, 1991, 1992a, b, and 1993a), the U.S. Army Corps of Engineers (COE 1988, 1991), and Woodward-Clyde Consultants (WCC 1988) from five areas of the Oakland Harbor (Inner and Outer Harbor Channels, Inner and Outer Harbor Berthing Areas, and the Turning Basin Wing). The potential for human health risks associated with proposed upland disposal of these dredged sediments was evaluated in the HHRA, based on the distribution of chemicals detected in the dredged sediment, and proposed activities following deposition of sediments at the property.

The HHRAs were conducted in accordance with appropriate U.S. Environmental Protection Agency (EPA 1989a, b; 1991a) and California Environmental Protection Agency (Cal/EPA 1992a, b) guidelines for human health risk assessments. Conservative (i.e., health-protective) exposure assumptions were used in the assessment, to provide an upper-bound evaluation of the potential health risks associated with the proposed project. The following text outlines the bases for the chemicals and human receptor populations evaluated in the HHRA and discusses the results of the evaluation.

After considering the potential human populations that could be exposed to dredged sediment, receptors were chosen that represented the types of people most likely to be exposed to dredged sediment at each site. Each of these receptor populations was evaluated based on the likelihood of chemical exposure via incidental ingestion and dermal (skin) contact with dredged sediment, and inhalation of sediment particles entrained in air as dusts. For both the dermal and ingestion exposure pathways, it was assumed that a receptor population would be exposed to the chemicals at the same concentrations measured in the dredged sediment samples (Battelle 1988, 1990, 1991, 1992a, b, and 1993a; COE 1988, 1991; and WCC 1988). To evaluate the potential inhalation of dusts, mathematical air dispersion models were used to estimate chemical concentrations in dust generated from each site during proposed activities (EPA 1990a).

For each receptor population, average and reasonable maximum exposure (RME) scenarios were developed to estimate hypothetical exposures to chemicals following the deposition of dredged sediment. The average exposure scenario represents a "typical" exposure, believed to be most likely to occur, while the RME scenario represents a "plausible worst case" situation -- one that is not very likely to occur. The RME scenario is evaluated so that an upper-bound estimate of potential adverse effects can be identified. It is assumed that by evaluating an RME scenario, potential health risks to extremely sensitive individuals within a particular receptor population will be adequately addressed.

Volume-weighted estimates of likely and maximum chemical concentrations in sediment were used to evaluate the average and RME scenarios, respectively. The average exposure scenario also incorporated more typical intake assumptions (e.g., representing the 50th percentile) to estimate potential health risks and noncancer health effects. The RME scenario incorporated upper-bound estimates for intake assumptions (e.g., representing the 90th or 95th percentile). Both average and RME exposure scenarios assumed that all receptor populations would be exposed to chemicals on a continuous basis over the assumed exposure duration, and (for workers) that standard health and safety practices would not be followed (e.g., workers would constantly be in direct contact with chemicals, and would not wash after exposure). For both exposure scenarios, potential cancer risks and noncancer health effects were estimated for each pathway of exposure (i.e., inhalation of dusts, incidental ingestion and/or dermal contact with sediments). The risk estimates for individual exposure pathways for each human receptor population were then summed to derive total average and RME exposure estimates for all chemicals except lead. Due to the complex toxicokinetic properties of lead in the body, EPA (1990b) and Cal/EPA (1991, 1992b) pharmacokinetic models were used to estimate blood-lead levels of each receptor; the results of the evaluation were compared with appropriate agency standards to assess the potential for adverse health effects that may occur from lead exposure.

Chemicals Evaluated in the HHRA

For conducting HHRA's, the EPA (1989a) has published recommended guidance to identify chemicals of potential concern (COPCs). COPCs typically represent a subset of all chemicals detected at a site that may possibly be harmful to humans if excessive exposures occur. Identification of COPCs is typically based on criteria such as the following:

- Frequency that a chemical was detected.
- Degree of toxicity to humans.
- Potential for migration from one environmental medium (e.g., soil) to another (e.g., air).
- Whether the chemical is naturally occurring or present due to anthropogenic (i.e., human) activities.

This selection process allows a risk assessment to focus on the most prevalent, mobile, and toxic chemicals detected at a site. As a health-protective measure, no such selection process was used in the these HHRA's. Rather, it was assumed that all chemicals detected in the dredged sediment samples could represent a potential health risk to exposed humans, and therefore all detected chemicals were evaluated in the HHRA's. It is important to note that this approach could possibly result in an overestimation of the risks associated with deposition of the dredged sediments on the property. For example, it is likely that using this conservative approach, the HHRA evaluated potential health effects resulting from exposure to naturally occurring metals as well as those present due to anthropogenic activities.

Impact Significance Criteria

The results of the HHRA's (both average and RME scenarios) were compared with the following six values:

- Annual average National Ambient Air Quality Standards (NAAQS) and the California Ambient Air Quality Standards (CAAQS) of 50 and 30 micrograms of dust per cubic meter of air, respectively.
- The Cal/EPA (1992b) and EPA (1991b) target blood lead level of 10 micrograms per deciliter.
- EPA's target risk range of 10^{-4} to 10^{-6} (i.e., a one-in-10,000 probability (10^{-4}) or a one-in-1,000,000 (10^{-6}) probability that an exposed individual will develop cancer over his or her lifetime from chemical exposure (EPA 1990c).
- Cal/EPA's target risk of 10^{-6} for cancer risks.
- The Cal/EPA (1992a) and EPA (1989a) value of 1.0 for noncancer health effects. Potential noncancer effects are evaluated by dividing estimated doses predicted for each receptor by agency-developed toxicity values. The toxicity values represent chemical doses below which noncancer effects are not expected. If the above-mentioned ratio exceeds 1.0, there may be an indication that noncancer health effects may occur.
- California Safe Drinking Water and Toxic Enforcement Act (SDWTEA) No Significant Risk Levels, which are health-protective exposure levels established for chemicals known to the State of California to cause cancer or reproductive toxicity (Proposition 65; HWA 1988).

For the purposes of this EIR/S, if estimated cancer risks or noncancer health effects exceeded any of the above six values, they were then considered potentially significant if unmitigated. It is important to note, however, that the HHRA was based on a number of conservative exposure and intake assumptions. It is therefore likely that the cancer risk and noncancer health effects predicted for each receptor population were overestimated based on proposed activities and expected future site conditions.

4.9.2 Leonard Ranch/Redwood Landfill

4.9.2.1 Potentially Exposed Human Populations and Exposure Pathways

This HHRA addresses potential health risks associated with the following proposed activities at the Leonard Ranch Rehandling Site following deposition of the dredged sediment at the site:

- Loading of dredged sediment into trucks for transport off site to the Redwood Landfill, expected to occur over a period of approximately 18 to 24 months.

After considering a number of human populations that could possibly be exposed to chemicals during proposed loading and hauling activities, the following human receptor populations were selected for evaluation in the HHRA:

- Off-site child and adult residents currently living near the Leonard Ranch Rehandling Site.

- On-site dredged sediment workers present on the property during proposed loading and hauling activities.

4.9.2.2 Project Impacts

The results of the analyses indicate that the estimated dust-in-air concentrations would not exceed the NAAQS or CAAQS at any of the receptor locations. Exposures to lead are not expected to result in blood lead levels above the agency target level of concern for any of the receptors evaluated. In addition, for the child and adult residents currently living near the Leonard Ranch Rehandling Site, estimates of the average and RME cancer risks and noncancer health effects were predicted to be well below agency target levels of concern. For the dredged sediment workers, estimates of noncancer health effects were also predicted to be below agency target levels of concern for both the average and RME scenarios. Average estimates of cancer risk for these workers were at EPA and Cal/EPA target levels of concern, indicating that excess risks are not expected. RME estimates of cancer risk were within the EPA's acceptable range and were slightly above Cal/EPA's target level of concern. All projected exposures were below or well below the State of California's No Significant Risk Levels.

On the basis of these results, potential exposures to chemicals in dredged sediment proposed for placement at the Leonard Ranch Rehandling Site are not expected to result in either cancer or noncancer health effects to nearby residents during proposed loading and hauling activities. The slightly elevated health risks estimated for the dredged sediment worker (RME scenario) are considered to represent upper-bound estimates based on the conservative exposure assumptions outlined in the HHRA, and are not considered likely to occur at the site in the future (EPA 1989a). The results of the average exposure scenario for this receptor (expected to be more representative of future site activities and conditions) illustrates that excess health risks are not expected to occur.

4.9.2.3 Mitigation Measures

Although RME exposures to dredged sediment workers are not considered likely to occur in the future, the use of mitigation measures during project implementation can help reduce the potential for chemical exposures by managing workplace activities in accordance with an applicable Health and Safety Plan (HSP). HSP components that address exposure of the dredged sediment worker at the site include (but are not limited to) the following activities:

- Providing education to dredged sediment workers on compliance with applicable Occupational Safety and Health (OSHA) and State of California OSHA regulations, and steps to minimize exposure (e.g., washing; wearing long-sleeved shirts and long pants).
- Providing facilities for workers to wash following site activities.
- Designating specific areas for workers to eat, drink, and smoke.

4.9.3 Galbraith Golf Course

4.9.3.1 Potentially Exposed Human Populations and Exposure Pathways

This HHRA addresses potential health risks associated with the following proposed activities at the Galbraith Golf Course following deposition of the dredged sediment at the site:

- Tilling activities to accelerate the drying of dredged sediment, expected to occur over a period of 24 to 30 months.
- Grading activities to redevelop Galbraith Golf Course into an active facility, expected to occur over a period of approximately 18 months.

After considering a number of human populations that could possibly be exposed to chemicals during proposed tilling, and grading activities, the following human receptor populations were selected for evaluation in the HHRA:

- Off-site child and adult residents currently living near the golf course.
- Off-site workers and golfers at the nearby driving range and snack bar.
- Off-site workers at nearby businesses.
- On-site dredged sediment workers working at the golf course during proposed tilling and grading activities.
- On-site golf course maintenance workers working at the golf course following completion of the proposed redevelopment activities.

Noncancer health effects and cancer risks for off-site receptors at nearby businesses and the driving range were evaluated by comparing expected exposure levels with those considered for the off-site resident and the on-site dredged sediment worker receptor. This approach is discussed further in the *Draft Human Health Risk Assessment for the Leonard Ranch Rehandling Site, Galbraith Golf Course, and Ninth Avenue Terminal* (HLA 1994a).

4.9.3.2 Project Impacts

The results of the analyses indicate that the estimated dust-in-air concentrations would not exceed the NAAQS or CAAQS at any of the receptor locations. Exposures to lead are not expected to result in blood lead levels above the agency target level of concern for any of the receptors evaluated. For residents currently living near the golf course, both the average and RME estimates of cancer risks and noncancer health effects were predicted to be well below agency target levels of concern. For the golf course maintenance workers, the average and RME estimates of noncancer health effects were also well below agency target levels of concern. Estimates of cancer risk for these workers were below the EPA target range and the Cal/EPA target level for the average scenario; RME estimates were within the EPA target range, and slightly above the Cal/EPA target level of concern. For the dredged sediment worker, estimates of noncancer effects were below the agency target levels of concern for the average and RME

scenarios. Average and RME cancer risks estimated for the dredged sediment worker were within EPA's target risk range, and above Cal/EPA's target level. All projected exposures were below or well below the State of California's No Significant Risk Levels.

On the basis of these results, potential exposures to chemicals in dredged sediment proposed for placement at the Galbraith Golf Course are not expected to result in either cancer or noncancer effects to off-site receptors during proposed tilling and grading activities. The slightly elevated health risks estimated for the dredged sediment worker (average and RME) indicate that exposure to chemicals detected in the sediment may result in adverse health effects. The slightly elevated health risks estimated for the dredged sediment worker (average and RME exposure scenarios) indicate that exposure to chemicals detected in the sediment may possibly result in adverse health effects, if exposures are similar to those outlined in the HHRA, and if standard worker health and safety practices are not used during site activities. The slightly elevated health risks estimated for the golf course maintenance worker (RME exposure scenario) are considered to represent upper-bound estimates based on the conservative exposure assumptions outlined in the HHRA, and are not considered likely to occur at the site in the future (EPA 1989a). The results of the average exposure scenario for this receptor (expected to be more representative of future site activities and conditions) illustrates that excess health risks are not expected to occur for this population.

4.9.3.3 Mitigation Measures

For the dredged sediment workers, the use of mitigation measures during project implementation can help reduce the potential for chemical exposures by managing workplace activities in accordance with an applicable Health and Safety Plan (HSP). HSP components that address exposure of the dredged sediment worker at the site include (but are not limited to) the following activities:

- Providing education to dredged sediment workers on compliance with applicable Occupational Safety and Health (OSHA) and State of California OSHA regulations and steps to minimize exposure (e.g., washing; wearing long-sleeved shirts and long pants).
- Providing facilities for workers to wash following site activities.
- Designating specific areas for workers to eat, drink, and smoke.

Although RME exposures to the golf course maintenance worker are not considered likely to occur in the future, mitigation measures during golf course development can also help reduce the potential for chemical exposures to this population. Placement of sufficient amounts of clean soil on top of the dredged sediment deposited at the site, is expected to reduce the health risks estimated for the golf course maintenance worker to levels below Cal/EPA's target risk.

4.9.4 The Port/Landfill

4.9.4.1 Potentially Exposed Human Populations and Exposure Pathways

This HHRA addresses potential health risks associated with the following proposed activities at the Ninth Avenue Marine Terminal following deposition of the dredged sediment at the site:

- Tilling activities to accelerate the drying of dredged sediment over a period of 9 months (3 cycles lasting 3 months each).
- Loading of dredged sediment into trucks for transport to a yet-to-be-determined Class II or III landfill, expected to occur over a period of approximately 3 months (3 cycles lasting 1 month each).

After considering a number of human populations that could possibly be exposed to chemicals during proposed tilling, loading, and hauling activities, the following human receptor populations were selected for evaluation in the HHRA:

- Off-site child and adult residents currently living near the Ninth Avenue Marine Terminal.
- Off-site industrial workers adjacent to the Ninth Avenue Marine Terminal.
- Dredged sediment workers present on the property during proposed tilling, loading, and hauling activities.

4.9.4.2 Project Impacts

The results of the analyses indicate that the estimated dust-in-air concentrations would not exceed the NAAQS or CAAQS requirements at any of the receptor locations. Exposures to lead are not expected to result in blood lead levels above the agency target level of concern for any of the receptors evaluated. For off-site residents and workers currently living/working near the Ninth Avenue Marine Terminal, both the average and RME estimates of cancer risks and noncancer health effects were predicted to be well below agency target levels of concern. For the dredged sediment worker, estimates of noncancer health effects were also below agency target levels for both the average and RME scenarios. Average and RME cancer risks estimated for the dredged sediment worker were within EPA's target risk range and slightly above Cal/EPA's target levels of concern, indicating that excess risks are not expected. All projected exposures were below or well below the State of California's No Significant Risk Levels.

On the basis of these results, potential exposures to chemicals in dredged sediment proposed for placement at the Ninth Avenue Marine Terminal are not likely to result in either cancer or noncancer effects to nearby residents during proposed tilling, loading, and hauling activities. The slightly elevated health risks estimated for the dredged sediment worker (average and RME scenarios) indicate that exposure to chemicals detected in the sediment may possibly result in adverse health effects, if exposures are similar to those outlined in the HHRA, and if standard worker health and safety practices are not used during site development.

4.9.4.3 Mitigation Measures

For the dredged sediment workers, implementation of mitigation measures during project implementation can help reduce the potential for chemical exposures by managing workplace activities in accordance with an applicable Health and Safety Plan (HSP). HSP components that address exposure of the dredged sediment worker at the site include (but are not limited to) the following activities:

Impacts -- Human Health Risk Assessment

- Provide education to dredged sediment workers on compliance with applicable Occupational Safety and Health (OSHA) and State of California OSHA regulations and steps to minimize exposure (e.g., washing; wearing long-sleeved shirts and pants).
- Provide facilities for workers to wash following site activities.
- Designate specific areas for workers to eat, drink, and smoke.

5.0 CONSISTENCY WITH LAND USE PLANS AND POLICIES

This section addresses project consistency with existing and planned land uses, as well as consistency with plans and policies. Impacts would be considered significant if the proposed project or its alternatives conflicted with existing land use designations and the plans, policies, or regulations established by the governmental entities of the jurisdictions that would be directly affected by implementation of the project. Impacts would also be considered significant if project implementation resulted in the permanent conversion of prime agricultural land to non-agricultural uses or would be potentially significant if use of existing or planned recreational resources were precluded or substantially impeded for at least six months. Under NEPA, the loss of the recreational facility is considered a significant impact on the human environment. Under CEQA the significance is less clear. CEQA Guidelines Section 15131(a) state that "economic or social effects of a project shall not be treated as significant effects on the environment." However, Appendix G of the CEQA Guidelines list as a significant effect "conflict with established recreational, religious or scientific uses of the area." For the purposes of this discussion, the loss of recreational opportunities shall be considered a significant impact under both NEPA and CEQA.

5.1 REGIONAL

The San Francisco Bay is a natural bay that encompasses 548 square miles of inland waterways on the northern California coast (Bay Conservation and Development Commission [BCDC] 1991 in COE and Port of Oakland 1991). The Bay Area region is made up of a nine-county area in Northern California; these counties are Solano, Contra Costa, Marin, Sonoma, San Francisco, Napa, San Mateo, Santa Clara, and Alameda. Population for the nine-county region is about 5.5 million people. The Bay Area is one of the major shipping and port centers on the west coast. The primary commercial shipping centers in the Bay Area are San Francisco, Richmond, and Oakland. The Port of Oakland, located in Alameda County, is the largest commercial shipping center of the three.

The BCDC exercises regulatory authority over all filling and dredging in San Francisco Bay and over all development within 100 feet of the shoreline. As a coastal zone agency, BCDC jurisdiction may extend beyond the 100-foot shoreline band into adjacent lands identified in area plans. BCDC's *San Francisco Bay Plan (Bay Plan)* provides that shoreline sites especially well-suited to six high-priority, water-oriented uses be reserved for such uses, one of which is ports.

The Metropolitan Transportation Commission (MTC) is the Regional Transportation Planning Agency for the Bay Area, responsible for comprehensive transportation planning and financial programming. Together with BCDC, MTC adopted the *San Francisco Bay Area Seaport Plan* in 1982 and approved amendments to the Plan in 1989. Major goals of the *Seaport Plan* applicable to the proposed project are to ensure the continuation of the San Francisco Bay Port system as a major world port and contributor to the economic vitality of the San Francisco Bay Region; to maintain or improve the environmental quality of San Francisco Bay and its environs; and to provide for the efficient use of finite physical and fiscal resources consumed in developing and operating marine terminals (BCDC and MTC 1982/1988; personal communication, Travis 1993). In addition to the *Seaport Plan*, MTC is also responsible for the *Regional Airport System Plan*.

Any regional changes in land use as a result of project dredging would occur over an extended period of time, and would be incremental. Land use impacts would be negligible in relation to the overall regional land use pattern and operations of existing land uses.

Land use plans and policies are described in subsequent sections for each project site.

5.2 OAKLAND HARBOR

5.2.1 Affected Environment

The Port of Oakland is located on the eastern side of San Francisco Bay, immediately south of the San Francisco-Oakland Bay Bridge in the City of Oakland, Alameda County (Figure 1-2). The Port's marine terminal facilities occupy about 550 acres, with 27 deepwater berths, 29 container cranes, and about 600,000 square feet of on-dock covered storage space. The Union Pacific and Southern Pacific transcontinental railroads maintain container transfer facilities at the Port. Other principal uses adjacent to the Port's maritime operations include the U.S. Naval Supply Center-Oakland (NSC Oakland), a 541-acre military facility that provides supply support services for the Pacific Fleet, and the Oakland Army Base, occupying about 422 acres (personal communication, Maroni, Zaleski 1993).

Port of Oakland harbor facilities occupy three contiguous areas referred to as the Outer Harbor, Middle Harbor, and Inner Harbor. The Outer Harbor fronts on San Francisco Bay and consists of 17 active berths at 8 marine terminals: Bay Bridge; Sea-Land; Yusen; Maersk Line; TransBay Container; Matson; TraPac; Marine Container; plus Berth 40. This area also includes Oakland Army Base Pier 7. The Middle Harbor extends easterly about 2 miles from the entrance to the Inner Harbor Channel and contains the American President Lines Terminal, with four berths. NSC Oakland, with four piers, is located immediately north of the entrance to the Inner Harbor Channel. The Inner Harbor extends easterly about 2 miles from the Middle Harbor, and contains two terminals, the Howard Container Terminal and the Ninth Avenue Terminal, with a total of five berths. This area also includes Jack London Square, other commercial and office uses, and residential and industrial uses (Port of Oakland 1992).

The Inner Harbor Channel extends along the common boundary of the cities of Oakland and Alameda and consists of an improved estuary channel 35 to 38 feet deep and from 600 to 800 feet wide with widened areas and a turning basin at the eastern terminus of the Inner Harbor. The Outer Harbor consists of a 3.4-mile-long channel, 600 to 800 feet wide and 35 feet deep, extending from deep water in central San Francisco Bay and terminating at the head of Outer Harbor. The Outer Harbor and much of the Inner Harbor Channel and the Inner Harbor land area lie within a Tideland Trust Area, but all of the Outer Harbor within the City of Oakland has been granted by the State to the Port, and almost all of the Inner Harbor within the City of Oakland and within the City of Alameda has been granted by the State respectively to the Port and the City of Alameda. The Naval Supply Center lies along the Inner Harbor Channel just east of the Seventh Street Terminals. Naval Air Station Alameda lies opposite the Port's harbor area along the Inner Harbor Channel and within the City of Alameda.

The harbor area is designated Port-Related Uses in the 1980 *Land Use Element* of the *Oakland General Plan*. The harbor area's primary land use designation in the 1968 *Port Shoreline Plan* is Shipping, with an Industrial use designation at the Union Pacific Intermodal Yard in the Middle Harbor area, and Residential, Recreation-Open Space and Commercial use designations in the Inner Harbor area.

Both the *Bay Plan* and the *Seaport Plan* designate the Port of Oakland as a port priority use area. Policies in the *Seaport Plan* are intended to protect port priority use areas for marine terminals and directly related ancillary activities, such as container freight stations, transit sheds, ship repairing, support transportation uses, freight forwarders, government offices related to the port activity, chandlers and marine services.

The *Seaport Plan* contains a finding that some improvement to the deepwater channel system in the Bay Area will be required to economically accommodate the vessels of the future, and that, generally, the most significant economic benefits of channel deepening are derived from the movement of containerized cargoes and crude petroleum in larger vessels.

5.2.2 Project Impacts

The proposed Deep-Draft Navigation Improvement project would be confined to the Outer and Inner Harbor Channels and associated berthing areas. Except for the relocation of existing submarine utilities and the removal of existing pier structures in the vicinity of the proposed construction work, no existing facilities would be altered by the project. The proposed project, in itself, would not guarantee any increase in cargo through the Port, nor would it necessitate any expansion of Port facilities. Current Port facilities associated with marine terminal operations have yet to reach capacity. Any demand for the construction of additional onshore facilities would be the result of market conditions, rather than a result of increased shipping channel access.

The proposed project would be consistent with the *Oakland General Plan* and the 1968 *Port Shoreline Plan*. To the extent that greater use would be made of the existing facilities by vessels that cannot now be accommodated by the existing channels, the proposed project would be consistent with the applicable goals, policies, recommendations and findings of the *San Francisco Bay Area Seaport Plan*, and, thus, the *San Francisco Bay Plan and Regional Transportation Plan*.

The proposed project would support the *Seaport Plan's* goal for ensuring the continuation of the San Francisco Bay Port system as a major world port and contributor to the economic vitality of the San Francisco Bay Region. The proposed project would be consistent with *Plan* policies to make full use of existing facilities, thereby reducing pressure to create marine terminal facilities, and possible new fill, for deep-draft vessels elsewhere on the Bay. The proposed project would implement the *Plan's* recommendation for deepening channels that would otherwise limit the productivity of marine terminals, and would be consistent with the *Plan's* finding that improvements to the deepwater channel system will be required to economically accommodate vessels of the future.

Should future market conditions create a demand for additional onshore facilities, the required permit applications would be the subject of environmental analysis and review as appropriate at that time.

5.2.3 Mitigation Measures

No significant land use impacts have been identified for the Oakland Harbor area associated with the project, so no mitigation measures are recommended.

5.3 DISPOSAL SITE OPTIONS

5.3.1 Ocean Section 102

5.3.1.1 Affected Environment

This disposal site is located on the continental rise approximately 49 nautical miles from the coast and 50 nautical miles from the Golden Gate Bridge. It is located in the waters of the United States and is outside the jurisdiction of local land use plans and policies. Ocean disposal of dredged material in general is regulated under two federal laws: Title I of the Marine Protection, Research, and Sanctuaries Act (MPRSA) and Section 404 of the Clean Water Act (CWA). The CWA regulates discharge into waters of the United States and MPRSA regulates discharge in the territorial sea and beyond. There is some overlap between the two laws; however, in general MPRSA supersedes the CWA when dredged material is transported through or disposed of in the territorial sea (within 3 miles of shore) and the CWA supersedes the MPRSA when dredged material is deposited for beach restoration or other beneficial purposes.

5.3.1.2 Project Impacts

The U.S. EPA and the Corps share responsibility for the management of ocean disposal of dredged material. With concurrence from the EPA, the Corps issues permits under MPRSA Section 103 for the transport and ocean disposal of dredged material deemed suitable according to EPA criteria in MPRSA Section 102 and EPA regulations in 40 CFR Part 227. Ocean disposal sites must be evaluated using EPA's ocean dumping criteria in 40 CFR Part 228. The disposal site under consideration in this section was evaluated and found to satisfy both the general and specific criteria established by the EPA (1992) for designation as a deep-water ocean dredged disposal site under MPRSA Section 102. EPA site designation is expected in June 1994.

Extremely limited commercial and recreational fishing occurs in the Ocean Section 102 area (EPA 1993a). Potential impacts on commercial and recreational fishing activities have been determined to be adverse but not significant as a result of disposal of dredged sediments at the Ocean Section 102 site (EPA 1993a).

5.3.1.3 Mitigation Measures

No mitigation measures are required.

5.3.2 Alcatraz

5.3.2.1 Affected Environment

This site is located 0.3 nautical miles south of Alcatraz Island in San Francisco Bay. Since it is located within the waters of the United States, jurisdictional authority lies primarily with the BCDC, Corps, EPA, and Regional Water Quality Control Board (RWQCB). The site has been identified as a dredged material disposal site under Section 404 of the CWA.

The primary plan governing development in San Francisco Bay is the *Bay Plan*, which is implemented by the BCDC. Permits and consistency concurrences/certifications for dredging and disposal activities are issued by the BCDC, if it finds the activities to be consistent with the McAteer-Petris Act and the *Bay Plan*.

5.3.2.2 Project Impacts

The Dredging Findings and Policies of the *Bay Plan* state that regular dredging of San Francisco Bay is essential to the economic and social welfare of the San Francisco Bay region. However, the *Bay Plan* finds that limited capacity and potential adverse impacts to Bay resources make dredged material disposal at existing in-Bay sites problematic. The *Bay Plan's* Dredging Policies No. 2, 4, and 5 provide that the maximum amount of dredged material should be disposed at non-tidal sites (preferably for beneficial use) or at ocean sites, unless such options are infeasible. Selection of the Alcatraz site would be potentially inconsistent with the *Bay Plan* policies concerning appropriate disposal sites, since alternative methods of disposal are feasible. In addition, pursuant to the *Bay Plan's* dredging policy #5, use of the Alcatraz site would comply with the BCDC's laws and policies only if disposed material is carefully managed to ensure that the amount and timing of disposal does not create navigational hazards, does not adversely affect Bay currents or its natural resources, or does not foreclose the use of the site by other projects critical to the regional economy. Since the project would potentially preclude use of the site for disposal of sediment from maintenance dredging projects for existing navigation channels, it would be inconsistent with this policy.

The Water Quality policies of the *Bay Plan* state, in part, that pollution of Bay waters should be avoided, and that water quality in the Bay should protect its beneficial uses. The *Bay Plan* dredging policies state, in part, that adequate testing of sediments should be performed prior to commencement of dredging and disposal activities. As described in section 4.2, Hydrology, Groundwater, and Water Quality, the sediments to be dredged have been tested by the Corps, and no significant water quality impacts would result from use of the Alcatraz site. Thus, use of this site is potentially consistent with *Bay Plan* policies concerning water quality.

Because daily dredged material disposal operations would be relatively infrequent, and since increased turbidity at the Alcatraz site shows little correlation to fish catch success, it has been determined that disposal of dredged material at the Alcatraz site would not significantly impact commercial or sport fishing activities (COE 1992a).

5.3.2.3 Mitigation Measures

No significant mitigation measures have been identified. No mitigation is required.

5.3.3 Bay Farm Borrow Area

5.3.3.1 Affected Environment

This site is located in San Francisco Bay, several hundred feet west of Bay Farm Island. As described for Alcatraz, jurisdictional authority lies primarily with the BCDC, Corps, EPA, RWQCB, and the City of Alameda. Available information on recreational boating and fishing in the Bay Area does not indicate that the BFBA is preferred as a recreational use area.

5.3.3.2 Project Impacts

The discussion in section 5.3.2 regarding consistency with *Bay Plan* water quality policies concerning use of in-Bay disposal sites applies to this site, as well. As described immediately above, the dredged sediments have been tested; however, as discussed in section 4.2.7.3, dredged material placement of "unsuitable" material at the site has the potential for the short-term depletion of dissolved oxygen and the release of contaminants to the environment. Mitigations have been recommended to minimize this impact. If they are implemented, selection of this alternative would be potentially consistent with the current water quality policies of the *Bay Plan*. However, the BCDC considers in-Bay disposal to be inconsistent with other *Bay Plan* dredging policies that emphasize the designation and use of non-Bay options. *Bay Plan* policy No. 2 states, in part, that in-Bay disposal should be allowed only when disposal to non-tidal areas or the ocean is infeasible. It appears that non-tidal sites, such as the Sonoma Baylands site, could well be feasible within the time frame of the project, and that an ocean disposal site will likely be available as well. The *Bay Plan* policies also state that dredged material should be used as a resource whenever possible. Disposal of material with elevated levels of contaminants at the BFBA would not be considered a use as a resource. Further, the *Bay Plan* states that disposal in the Bay should be to locations designated by the BCDC. The BFBA is not designated as a dredged material disposal site by the BCDC. It is unlikely that the BCDC could approve and designate this disposal site, particularly for material with elevated contaminant levels, without extensive information on the impacts of using the site, the completion of a demonstration project that showed that such use would not adversely impact the Bay's natural resources, and convincing documentation as to why alternatives preferred in BCDC policy are unacceptable (personal communication, Travis 1993).

Minor adverse impacts on commercial and recreational fishing may result from direct vessel interference during site operations. These impacts are not expected to be significant (PTI 1989).

5.3.3.3 Mitigation Measures

No mitigation measures are required beyond those described in section 4.2.

5.3.4 Leonard Ranch/Redwood Landfill

5.3.4.1 Affected Environment

Leonard Ranch Rehandling Option

Leonard Ranch, in Sonoma County, is proposed to be used as a dredged material drying and transfer site prior to the disposal of the dried dredged material at Redwood Landfill in Marin County. The distance between the two sites is about 10 miles via State Route (SR) 37 and U.S. Highway 101. The site under consideration for rehandling consists of 230 acres within the 830-acre former Leonard Ranch located at the intersection of SR 37 and Lakeville Highway, 10 miles south of the City of Petaluma and at the northern boundary of San Pablo Bay in unincorporated southern Sonoma County. SR 37, the Northwestern Pacific Railroad right-of-way, and the outboard protective levee separate the former Leonard Ranch into three sections: the northern, middle, and southern basins. The portion of the property proposed for sediment rehandling occupies the middle basin and is bounded by SR 37 on the north, Reclamation Road on the east, the Northwestern Pacific Railroad right-of-way on the south, and

Port Sonoma-Marin and Silva Lane on the west (Figure 3.4.3.4-2). Access to the site is from Jarvis Road via SR 37 and Reclamation Road.

The former Leonard Ranch property was purchased in 1990 by the Sonoma Land Trust, a nonprofit organization, with State Coastal Conservancy funding allocated by the California Wildlife, Coastal and Park Land Conservation Act (Proposition 70). The property was placed under an Agricultural Preserve (Williamson Act) contract in 1992. Uses are restricted by deed to those conservation and enhancement uses outlined in the *Sonoma Baylands Enhancement Plan* adopted by the Conservancy in 1989. The Plan specifies "muted tidal or seasonal wetlands and/or agriculture" as the approved use for the 230-acre Leonard Ranch site under each of three alternatives described in the Plan (personal communication, Vilms 1993). The LTMS project is studying a conceptual scheme to develop all or a portion of the 230-acre site into drying facilities for dredged material, for subsequent disposal at Redwood Landfill or other landfill sites. The proposed use of Leonard Ranch would require Coastal Conservancy Board approval of an amendment to the Plan (personal communication, Marcus 1993).

The former Leonard Ranch has been designated under the *Sonoma County General Plan* as Land Extensive Agriculture in the Land Use Element. SR 37 and Lakeville Highway are designated as Scenic Corridors. The 230-acre Leonard Ranch site is zoned LEA-F2-100-SR (Land Extensive Agriculture; Secondary Floodplain; 1 unit/100 acres; Scenic Resource) (personal communication, Rogers 1993). The placement of dredged materials on Leonard Ranch would require a zoning permit, with full environmental review, from the County of Sonoma (personal communication, Lehtinen 1993). The appropriate type of environmental document would be determined and prepared by County planning staff following a two-week review of the permit application by the Sonoma County Water Agency and other involved agencies (personal communication, Swedenborg 1993). The lead agency for the CEQA review of the Leonard Ranch rehandling alternative for Oakland Harbor is the Port of Oakland. The county is a responsible agency.

The purpose of the Land Extensive Agriculture District is to enhance and protect lands best suited for permanent agricultural use and capable of relatively low production per acre of land, and to implement the provisions of the Land Extensive Agriculture land use category of the General Plan and the policies of the Agricultural Resources Element.

General policy direction for land use decisions in agricultural areas is contained in the Land Use Element. Land use policy in agricultural areas is designed to protect lands currently in agricultural production and lands with soil and other characteristics which make them potentially suitable for agricultural use, to retain large parcel sizes, and to discourage uses that are not compatible with long-term agricultural production. Public uses such as parks and sewage treatment plants may be approved if an overriding public benefit exists (Land Use Element, Section 2.1.8).

Land use policy in land extensive agricultural areas is to enhance and protect lands capable of and generally used for the production of food, fiber, and plant materials. The objective in land extensive agricultural areas is to establish and maintain densities and parcel sizes which are conducive to continued agricultural production. Permitted uses in land extensive agricultural areas include agricultural production, processing, services and employee housing; visitor-serving uses; other resource uses, such as surface mining operations; and community facilities, such as public and private schools, churches, and granges (Land Use Element, Section 2.7.2).

Land Use Plans and Policies

Policies contained in the Agricultural Resources Element apply to lands within the County's three agricultural land use categories. The primary uses designated for any parcel within one of these categories are agricultural production and related processing, support services, and visitor-serving uses. Limited agricultural support services uses are permitted if they are not harmful to the long term agricultural use in the area. Under certain conditions, limited visitor-serving and recreational uses are permitted in the Land Extensive Agriculture category provided that (1) the use is compatible with existing agricultural production activities (or residential use) in the area; (2) the use will not require the extension of sewer or water; and (3) all potential conflicts are mitigated to the satisfaction of the County. (Agricultural Resources Element, sections 2.4, 2.5, and 2.6).

Lands placed in an Agricultural Preserve pursuant to the California Land Conservation Act of 1965 (Williamson Act) are to be retained in agricultural or open space uses for at least ten years, with an automatic renewal clause. A Type A-II agricultural contract applies to lands used for the preservation of open space uses or critical habitat, as well as for extensive agricultural operations. Open space use is defined as the use or maintenance of land in such a manner as to preserve its natural characteristics, beauty or openness for the benefit and enjoyment of the public, to provide essential habitat for wildlife, or for the solar evaporation of sea water in the course of salt production for commercial purposes if such land is within: (1) a scenic highway corridor; (2) a wildlife habitat area; (3) a salt pond; (4) a managed wetland area; or (5) a submerged area [Government Code Section 51202(o) and Board of Supervisors Resolution 89-0782 (May 2, 1989)].

The F2 Floodplain Combining District applies to properties which lie within the 100-year flood hazard area as shown on FEMA and County maps.

The purpose of the Scenic Resources Combining District is to preserve the visual character and scenic resources of lands in the County and to implement the provisions of the Open Space Element. General Plan policy is to preserve scenic resources; goals seek to retain the largely open, scenic character of important scenic landscape units. The General Plan goals further seek to preserve roadside landscapes that have a high visual quality as they contribute to the living environment of local residents and to the County's tourism industry. For parcels located both within scenic landscape units and adjacent to scenic corridors, General Plan policy is to apply the more restrictive siting and setback policies to preserve visual quality, and to establish a rural scenic corridor setback of 30 percent of the depth of the lot to a maximum of 200 feet from the centerline of the road, with development prohibited within the setback except for certain structures or under certain conditions (Open Space Element, sections 2.2 and 2.3).

The Long-Term Management Strategy, a regional plan for developing disposal strategy for dredged material from Bay ports and harbors, has identified the Leonard Ranch as a primary bayfront site for receiving dredge material by barge, drying it, and having it trucked away for beneficial use for liner, levee construction, or daily cover at the Redwood Landfill. Federal legislation authorizes the Corps to undertake environmental and engineering studies of a transfer facility at the Leonard Ranch through the Water Resources Development Act of 1992. A reconnaissance level feasibility study of the site was authorized by this act.

The Leonard Ranch site involves historic tidelands subject to the Public Trust Easement administered by the State Lands Commission. The Commission does not require permits for uses over easement lands, but uses may not be inconsistent with the public trust needs in the area (California Coastal Conservancy, Port of Oakland 1993).

The Leonard Ranch site was diked, drained, and converted from tidal marsh to upland area agricultural uses at the turn of the century and is currently used for the production of oat hay. It contains no prime farmland. A system of levees, drainage canals, and pumps is designed to prevent water from ponding on the site. A Pacific Gas & Electric (PG&E) transmission line crosses the site in a northeast/southwest trending direction, and a BAAQMD weather station is located near Reclamation Road. Structures in the southeastern corner of Leonard Ranch include a farm house, hay barn, smaller barn, repair shed, and scaling shack used as an auto parts drop. Visual characteristics of the site are described in Appendix F.

Land uses to the west in the vicinity of the 830-acre former Leonard Ranch include agriculture and Port Sonoma-Marin, with a public marina, adjacent to the Leonard Ranch rehandling site. Agricultural lands lie to the north and east. San Pablo Bay and the San Pablo Bay National Wildlife Refuge are to the south.

Redwood Landfill

Redwood Landfill is a Class III sanitary landfill that has been owned and operated privately since 1958 on a 600-acre site in unincorporated northeastern Marin County. The site is located approximately 4 miles north of the City of Novato, immediately east of the Northwestern Pacific Railroad right-of-way, south of the Sonoma County line, west of San Antonio Creek, a tributary of the Petaluma River, and north of South Slough (see Figure 2.7.4-1).

Regulatory authority for operation of the landfill, including the quality of imported dredged and other materials, is delegated by the State to Marin County Environmental Health Services (EHS), Department of Health and Human Services. In November 1990, Redwood Landfill was issued a Notice and Order from EHS stating that they were in violation of the terms and conditions of their solid waste facilities permit issued in 1978. Redwood Landfill was ordered to revise the solid waste facilities permit to accommodate the unauthorized practices and expected future changes and to conduct a CEQA review of those practices and expected changes. In the interim, the landfill is authorized to continue those practices which include accepting dredge materials. Redwood Landfill, Inc., has applied to EHS for a solid waste facilities permit for continuation of a Class III landfill on the disposal site until approximately the year 2039. This application is currently undergoing environmental review. A Final Environmental Impact Report that addresses the potential environmental impacts associated with the activities described in the permit application was distributed to the public for review in February 1994.

5.3.4.2 Project Impacts

Leonard Ranch Rehandling Option

Under this option, between 0.2 and 1.2 mcy of dredged material unsuitable for unconfined aquatic disposal would be discharged and dried at Leonard Ranch prior to transport to the end-use sites. Preparing the site would require 1.5 to 3 months; drying the dredged materials in multiple placement episodes would require 9 to 12 months; drying in a single placement episode, 12 to 18 months; and removing the materials would require approximately 3 to 9 months (Gahagan & Bryant 1993). The planned use of Leonard Ranch is a temporary (30-year) regional rehandling facility for dredged material (Port of Oakland 1993).

The 8-acre southeastern corner of the site is currently occupied by a house, barns, and various out-buildings and would remain in its present use. The PG&E transmission-line corridor bisecting the site and the weather station owned by the BAAQMD at the eastern edge of the site would remain in their present locations. About 188 acres of the site would be used for rehandling dredged materials. About 42 acres immediately west of the rehandling area would be available for wetlands creation. The adjacent 248-acre North Marsh would also be restored (see Figure 4.4.3.4-1).

In order for the proposed rehandling facility to be constructed, the State Coastal Conservancy Board must approve an amendment to the Sonoma Baylands Enhancement Plan, which designates the Leonard Ranch site for either muted tidal/seasonal wetlands or agricultural use. An amendment to the Enhancement Plan would be subject to the CEQA, and must comply with all environmental mitigation requirements, including a condition that the acreage dedicated to dredged materials rehandling be replaced with other natural lands (California Coastal Conservancy 1993).

The Leonard Ranch site is designated as Land Extensive Agriculture in the Land Use Element of the Sonoma County General Plan. General Plan goals seek to protect lands currently in agricultural production, to retain large parcel sizes, and to avoid incompatible non-agricultural uses. The General Plan discourages the conversion of lands currently used for agricultural production to non-agricultural uses, but provides that public uses may be approved if an overriding public benefit exists. The proposed rehandling facility would be inconsistent with the General Plan's policy to avoid conversion of lands in agricultural use unless it can be demonstrated that the facility would constitute an overriding public benefit. The proposed facility would be consistent with the General Plan's goal of retaining large parcel sizes and would be compatible with agricultural uses in the area. The wetland mitigation proposed for the project north of Highway 37 also would replace agricultural land, and could negatively affect agricultural production. However, this use is consistent with the Coastal Conservancy.

The site is designated as a Scenic Resources Combining District and is adjacent to the SR 37 Scenic Corridor. General Plan policy is to preserve the visual character and scenic resources of the county. The containment levee, proposed to be constructed to a height of +7.5 feet, would partially obstruct views to the south from SR 37 and Lakeville Highway, and would thus conflict with the General Plan. This potentially significant visual impact is described in Appendix F.

The site is zoned LEA (Land Extensive Agriculture); F2 (Secondary Floodplain); B6-100 (1 unit/100 acres density); SR (Scenic Resources) and is in an Agricultural Preserve. The proposed rehandling facility would require an amendment to the Sonoma County General Plan and approval of the proposed use by the County through a zone change and a use permit procedure (Sonoma County Department of Planning 1994). After receiving a completed permit application, the Planning Department would elicit comments from the County Water Agency and any other involved agencies, such as the County Health Department. Following a 2-week review and response period, staff would make a determination as to the appropriate type of environmental document to be prepared under CEQA (Negative Declaration, Expanded Initial Study, or Supplemental Environmental Impact Report). If the environmental document demonstrates that the project is mitigated sufficiently, the decision to approve or deny the project would be handled administratively by the staff. Alternatively, the application and the environmental document would be referred to the Environmental Review Committee (ERC) to determine the adequacy of the environmental document and to approve or deny the project. ERC decisions may be appealed to the Planning Commission (personal communication, Swedenborg 1993).

The BCDC does not have permit jurisdiction over the site, although a BCDC permit would be required for the dredged material pipeline. The proposed facility would be consistent with BCDC's Seaport Plan, which recognizes the potential significant economic benefits of channel deepening to accommodate containerized cargoes and crude petroleum in large vessels (see section 3.7.2). The proposed rehandling facility is consistent with the Long-Term Management Strategy, which identifies the Leonard Ranch site as a primary bayfront site for drying dredged materials (California Coastal Conservancy 1993).

The State Lands Commission administers a Public Trust Easement over the site's historic tidelands. At present, the Commission does not require permits for use of its Easement lands but does review such use to ensure it is not inconsistent with Public Trust needs in the area.

Impacts on adjacent land uses would not be significant. Placement of the slurry pipelines and construction of the dikes could result in localized minor construction traffic, noise, and air quality impacts in the vicinity. These impacts would be temporary and would not conflict with adjacent land uses. The PG&E transmission towers would require some modification, to be coordinated with PG&E. Any modification of existing drainage patterns or structures may require coordination with state and local agencies and surrounding property owners and easement holders. Construction at the site may adversely affect the collection of air quality data at the weather station and would require coordination with the BAAQMD. Modifications to the railroad embankment would require coordination with Northwestern Pacific Railroad (Gahagan & Bryant 1993). Drying and removing dredged materials would require the periodic use of earthworking equipment on the site, which may result in temporary noise and air quality impacts. Impacts on adjacent land uses during the sediment drying process would be intermittent and would not conflict with existing uses in the vicinity.

Redwood Landfill

Under this option, a portion of the material rehandled at the Leonard Ranch site would be transported to Redwood Landfill in unincorporated northeastern Marin County for use as daily cover. It is estimated that 0.2 to 1.2 mcy or more of silts and clays rehandled at the Leonard Ranch site would be transported to Redwood Landfill. Sand could be transported to other locations for use as construction fill. The material transported to Redwood Landfill would be used in conjunction with the pending application of the landfill owner/operator, Redwood Landfill, Inc., for continued operation of a Class III landfill on the site. This application is currently undergoing environmental review. The Final Environmental Impact Report was published in February 1994. No land use policy conflicts are expected as a result of the continued use (personal communication, Barnard 1993).

5.3.4.3 Mitigation Measures

Leonard Ranch Rehandling Option

To conform to State Coastal Conservancy bond fund requirements, the acreage dedicated to dredged materials rehandling shall to be replaced with other natural lands.

The setback of the containment levee from SR 37 shall be increased, thereby partially mitigating, the visual impact along the SR 37 Scenic Corridor and the Lakeville Highway Scenic Corridor. Notwithstanding this mitigation, the scenic resource quality of the Leonard Ranch site could be reduced

substantially by partial blockage of the existing expansive views of the bay plain. Therefore, residual impacts may remain significant after mitigation.

Redwood Landfill

No mitigation measures are required.

5.3.5 Sonoma Baylands

5.3.5.1 Affected Environment

Sonoma Baylands, in southern Sonoma County, is proposed to be used for the placement of dredged material to accelerate restoration of the site to tidal salt marsh habitat. The site proposed for restoration consists of 348 acres of diked, subsided historic tidelands within the 830-acre former Leonard Ranch located at the intersection of SR 37 and Lakeville Highway, 10 miles south of the City of Petaluma. The former Leonard Ranch is separated into three basins. The Sonoma Baylands site occupies the southern basin, bounded by the Northwestern Pacific Railroad right-of-way on the north, agricultural lands on the east, the San Pablo Bay Wildlife Refuge on the south, and Port Sonoma-Marin and the Petaluma River on the west (Figure 2.7.5-1). Access to the site is from Reclamation Road via SR 37. The site is currently used for oat hay production and contains no prime farmland.

The former Leonard Ranch property was purchased in 1990 by the Sonoma Land Trust, a nonprofit organization, with the State Coastal Conservancy funding allocated by the California Wildlife, Coastal and Park Land Conservation Act (Proposition 70). The property was placed under an Agricultural Preserve (Williamson Act) contract in 1992, and ultimately is expected to be transferred to the California Department of Fish and Game. In 1991, the Conservancy Board approved tidal marsh restoration for the 348-acre Sonoma Baylands site, with the primary goal of restoring habitat for the endangered California clapper rail and salt marsh harvest mouse (California Coastal Conservancy 1991b).

The former Leonard Ranch has been designated under the Sonoma County General Plan as Land Extensive Agriculture in the Land Use Element. SR 37 and Lakeville Highway are designated as Scenic Corridors. The 348-acre Sonoma Baylands site is zoned LEA (Land Extensive Agriculture), B6-100 (1 unit/100 acres density), F2 (Secondary Floodplain), SR (Scenic Resource). Applicable policies are described in section 5.4.4.1. Additionally, the site is designated as a scenic landscape unit in the Open Space Element, and the portion of the site along San Pablo Bay is designated BR (Biotic Resource).

General Plan policy is to preserve scenic resources; goals seek to return the largely open, scenic character of the important landscape units and to preserve roadside landscapes that have a high visual quality.

The Biotic Resource Combining District seeks to protect biotic resource communities including critical habitat areas and riparian corridors for their habitat and environmental value, and to implement the provisions of the Open Space Element. The Resource Conservation Element seeks to preserve the San Pablo Bay area as a biotic resource area and historic water retention basin of particular significance to Sonoma County's environment (Resource Conservation Element, Section 5.1). The Land Use Element contains additional policies which apply to the tidal marshlands bordering San Pablo Bay, including the restoration when possible of former marshes through removal of existing dikes, and the creation of some new marshes through carefully placed lifts or dredged spoils (Land Use Element, Section 3.9).

The San Francisco District, U.S. Army Corps of Engineers (Corps) is a participant in the interagency Long-Term Management Strategy dredging program, a regional plan for developing disposal strategy for dredged material from Bay ports and harbors. Under Section 106 of the Water Resources Development Act of 1992, the Corps has been authorized to prepare the 348-acre Sonoma Baylands site for receiving dredged material (Port 1993).

The southern periphery of the Sonoma Baylands site is located in an area subject to the permit jurisdiction of the San Francisco BCDC.

The Sonoma Baylands site involves historic tidelands subject to the Public Trust Easement administered by the State Lands Commission. The Commission may require a fee or permit for uses over easement lands, and uses may not be inconsistent with the public trust needs in the area (Conservancy, Port 1993).

The Sonoma Baylands site was diked, drained, and converted from tidal marsh to upland area agricultural uses at the turn of the century and is currently used for the production of oat hay. A system of levees, drainage canals, and pumps are designed to prevent water from ponding on the site. A PG&E transmission-line corridor crosses the western portion of the site in a northeast/southeast trending direction. Visual characteristics of the site are described in Appendix F.

Land uses in the vicinity of the Sonoma Baylands site include Port Sonoma-Marin, with a public marina, to the west. The Northwestern Pacific Railroad right-of-way and agricultural lands lie to the north. Agricultural lands and the Black Point Game Bird Club are located east of the site. San Pablo Bay and the San Pablo Bay National Wildlife Refuge are to the south.

5.3.5.2 Project Impacts

Under this option, up to 2.5 mcy of dredged sediments would be placed at the 348-acre Sonoma Baylands site to restore diked, subsided former bayland to tidal wetland. Preparing the site would require about five months; placement and consolidation of the dredged material would occur over a 21-month period. Six months after disposal, the bayfront levee would be breached to initiate tidal circulation. Development of intertidal marsh would require about 10 years.

The existing low perimeter levees would be substantially upgraded to protect adjoining properties and the adjacent railroad from flooding. Under this option, a series of interior peninsulas (branched interior berms) would be constructed using on-site material. Dredged material would be barged to an off-loading platform anchored southwest of the site in San Pablo Bay, then pumped as a slurry through an overland pipeline to points of discharge inside the perimeter levees. Dredged material would cover approximately 266 acres of the site. The existing agricultural use of the site would be discontinued. The PG&E transmission-line corridor crossing the western portion of the site would remain in its present location.

The placement of dredged materials on the Sonoma Baylands site would be consistent with the State Coastal Conservancy's approved use of the site under the Sonoma Baylands Enhancement Plan, which designates the 348-acre site for tidal marsh restoration.

The proposed use of the Sonoma Baylands site would result in the removal of about 315 acres from agricultural production, but appears to be consistent with the intent of General Plan policies and goals as a whole. Although general land use policies discourage the conversion of agricultural lands to other

uses, these policies also recognize that there may be an overriding public benefit for certain public uses. Policies in the Resource Conservation Element seek to preserve the San Pablo Bay area as a biotic resource area and historic water retention basin. Other policies in the Land Use Element call for the restoration of former marshes bordering San Pablo Bay. The proposed use of the site would be consistent with, and would implement, these policies.

The proposed use would be consistent with general plan policies and goals regarding the preservation of scenic landscape units and visual quality. The site is more than 1,000 feet south of SR 37 and is surrounded by existing levees. Views of the site from the SR 37 Scenic Corridor would not be affected by the proposed use. Views of the site from San Pablo Bay are not likely to be affected substantially by improvements to the existing perimeter levees (see visual assessment in Appendix F). Views from other locations accessible to the recreational public and to residents of Black Point in Marin County are also described in Appendix F.

The Conservancy has determined that the proposed use is consistent with the site's General Plan and zoning designations. The Corps and the Port will consult with Sonoma County and other responsible agencies through the SEIR/S process.

The site is under a Type A-II Agricultural Preserve (Williamson Act) contract. Type A-II agricultural contracts apply to lands used for the preservation of open space uses or critical habitat, as well as for extensive agricultural operations, and the proposed use appears to be consistent with terms of the contract.

The proposed use of the Sonoma Baylands site is consistent with the policies of the BCDC regarding the restoration of diked historic baylands to tidal action. The proposed use is consistent with dredging, marsh, and mudflat policies in BCDC's San Francisco Bay Plan.

The proposed use of the site is consistent with the goals of the inter-agency Long-Term Management Strategy dredging program, a regional plan for developing disposal strategy for dredged material from Bay ports and harbors.

The State Lands Commission administers a Public Trust Easement over the site's historic tidelands. At the present time, the Commission does not require permits for use of its Easement lands, but does review such use to ensure it is not inconsistent with Public Trust needs in the area.

Impacts on adjacent land uses would not be significant. Placement of the slurry pipeline and construction of the interior peninsulas could result in localized minor construction traffic, noise, and air quality impacts in the vicinity. These impacts would be temporary and would not conflict with adjacent land uses. The PG&E transmission-line towers would require some modification, to be coordinated with PG&E. Placement of the dredged material may result in temporary noise impacts. Impacts on adjacent land uses during site preparation would be temporary and would not conflict with existing uses in the vicinity.

5.3.5.3 Mitigation Measures

No mitigation measures are required.

5.3.6 Galbraith Golf Course

5.3.6.1 Affected Environment

The 165-acre Galbraith Golf Course, within the City of Oakland, is immediately west of Doolittle Drive and south of Hegenberger Road. Main access to the site is from Doolittle Drive. The site is bounded by the Metropolitan Oakland International Airport to the west and the City of San Leandro corporate limits to the south and east. A clubhouse is situated on the northern portion of the golf course. A soccer field is located between the 18th fairway and Doolittle Drive.

The site is designated Park, Recreation, Natural Area or Watershed in the 1980 Land Use Element of the Oakland General Plan and Recreation/Open Space in the 1968 Port Shoreline Plan.

The site is owned by the Port and leased to the City of Oakland, which subleases the operation and management of the 18-hole golf course, clubhouse and driving range to a property management firm, Ransom McKay Golf, Inc. The clubhouse restaurant and driving range are, in turn, subleased to other private operators. About 65,000 rounds of golf are played annually at the golf course and about 15,000 patrons per year use the driving range. The Oakland Parks and Recreation Department manages the soccer field. Use of the golf course is approximately 80 percent of capacity from Friday to Sunday, and about 50 percent of capacity Monday through Thursday.

An informal Junior Golf Program provides golf instruction and recreational activity for youth at the site. Total membership in the Junior Golf Program is variously reported as between 9 and 35 participants. According to several comments on the Draft SEIR/S, most of the youth are from minority or low-income families and most are Oakland residents. The program makes use of the general facilities and provides limited access to the 18-hole course on Saturday afternoons. Instruction is provided by volunteers. Many commentors on the Draft SEIR/S have praised this program for the social, moral, and educational benefits it has provided to the youth that have participated since the program was established in 1984.

The Galbraith Golf Course has been described by some commentors on the Draft SEIR/S as a unique facility because of the relaxed social atmosphere that allows cross-cultural and cross-generational relationships to form and to be bound by a common interest. This social atmosphere reportedly has taken many years to develop. Many of the people who come together at the golf course are from diverse backgrounds and do not come together under other situations. Many elders that work and play at the course find opportunities to be role models for the youth that participate in the junior golf program. Many golfers and others have expressed the opinion that the social atmosphere at the Galbraith Golf Course is unique for these reasons, and that it is not duplicated at any of the other golf courses in the East Bay area.

The golf course has been constructed over an area that was used as a landfill prior to 1965. Land uses in the vicinity include the Metropolitan Oakland International Airport, and commercial and industrial uses along Doolittle Drive. A water pollution control treatment plant and industrial waste monitoring facility is immediately adjacent to the southern boundary of the golf course, north of Davis Street in the City of San Leandro. Other uses near the western terminus of Davis Street include a public rifle and pistol range, the Davis Street Resource Recovery and Transfer Station Complex, a public dump, and the Oyster Bay Regional Shoreline. The Martin Luther King Jr. Regional Shoreline, Airport Channel, and Arrowhead Marsh are located north of Swan Way, about 1/2-mile north of Hegenberger Road. The golf

course is irrigated with reclaimed water purchased in accordance with a long-term agreement between the City, Ransom-McKay, and EBMUD.

5.3.6.2 Project Impacts

On November 16, 1993, the Port and City of Oakland agreed to a Memorandum of Understanding (MOU) under which the Port of Oakland would use the Galbraith Golf Course site as a dredged material disposal site. The proposed sediment disposal and drying site would include the area occupied by the 18-hole golf course and soccer field. Under this option, the Port will construct a new and improved golf course on the site to serve the Oakland community to replace the facilities eliminated by the disposal activities. Under this option, up to 1.2 mcy of dredged materials unsuitable for unconfined aquatic disposal would be placed at Galbraith Golf Course. The Port proposes to develop a new golf course on site at the end of the sediment drying process.

The existing soccer field on the Galbraith site will be lost and not replaced. The City of Oakland will bring a new soccer field into play at the Curt Flood Sports Complex in East Oakland during the summer of 1994. The new Sport Complex Soccer Field will be made available for use as a replacement field for the Galbraith Soccer Field by the City of Oakland Department of Parks and Recreation. The new field will mitigate completely the loss of the Galbraith field.

The drying of dredged material on the site will require that the existing public golf course be closed until the material is dried, and a new golf course is constructed by the Port pursuant to an agreement with the City of Oakland. According to the MOU with the City of Oakland, the golf course may be closed for up to 7 years (although extensions are allowed if required). The loss of the golfing facility in the interim is a significant impact upon the recreational opportunities available in the vicinity. There are over thirty 18-hole public golf courses in the greater Bay Area. However, almost all of these facilities are operating at or near capacity during the weekends, although substantial capacity to accommodate players who use the Galbraith facility is available at these other locations during the week.

The Port has considered many measures to reduce the recreational impact and, for those losses that are unavoidable, provide mitigation. The proposed design does not include the placement of dredged material over the existing driving range or the clubhouse, so impacts to these facilities can be avoided. The Port has considered drying the dredged material over only a portion of the golf course to retain at least half of the existing course in play. However this approach is infeasible because of the volume of sediments to be dried. As the site lies on the approach to two of the runways at the North Field of the Metropolitan Oakland International Airport, there are limitations regarding the height of structures (including dikes) that can be constructed at the site. The site also cannot be excavated to increase capacity because of the anticipated impacts from disturbance to the former landfill that underlies the site.

The Port continues to investigate methods to accelerate the drying process. However, no methods have been identified that would substantially reduce the drying time and still meet water quality standards for the water drained from the site.

Thus, if this disposal option is selected, the temporary loss of the golf course is an unavoidable significant recreational land use impact. However, the Port has committed to mitigating this loss for the informal youth golfing program, for seniors who are members at the seniors clubs at the Galbraith course, and for Oakland resident seniors. Subsidies for greens fees will be provided at a local golf course for the

members of the three seniors golf clubs associated with the Galbraith course, and Oakland resident seniors on weekdays. The Port has made arrangements to allow the youth program to continue at the Galbraith driving range. The City of Oakland will arrange with managers of other courses in the vicinity to allow the youth access to those courses on a basis similar to that provided at the current Galbraith facility. The responsibility for mitigating the project's impact on this program thus lies in facilitating access to locations to practice and play for the volunteer program. The proposed mitigation measures (see section 5.3.6.3) would adequately mitigate the impacts on the youth program, as well as the senior golfers. The recommended mitigation measure for the impact on the youth golf program would mitigate the impact to insignificance, and thus would fulfill the purpose and intent of Executive Order 12898.

However, the total impact upon the golfing community cannot be mitigated to a level of insignificance. As all of the municipal golf courses in the Bay Area are operating at capacity (or very close to it) during the weekends, the Galbraith golfers cannot be easily accommodated at these facilities without displacing other golfers. Construction of a new golf course elsewhere in the vicinity would cost in the neighborhood of \$8-10 million and is economically infeasible for the Port of Oakland. Lost golfing opportunities for the general golfers at Galbraith (i.e., golfers that are neither youths nor seniors) would thus be a significant, unmitigable impact associated with the proposed project.

During the period when the golf course is closed, the Port will assume the agreement between City of Oakland, EBMUD, and Ransom-McKay for the use of reclaimed water at Galbraith Golf Course. The Port is considering rerouting a portion of the water for irrigation of the proposed containment berms or Port properties such as Airport Drive.

The proposed ultimate reuse of the site as a golf course would be consistent with the 1980 Land Use Element of the Oakland General Plan and the 1968 Port Shoreline Plan. The proposed use of the site for the disposal and drying of dredged material would be consistent with these plans as an Interim Construction Phase prior to reconstruction of the golf course (Port 1993).

Impacts on adjacent land uses would be minimized by the proposed waterborne transport of the dredged materials to San Leandro Bay (Option A) or San Francisco Bay (Option B) and their subsequent pumping to the site via slurry pipelines. Unloading operations under either option should be located where they would not interfere with water recreation activities or sensitive shoreline areas, such as Arrowhead Marsh. Placement of the slurry pipelines and construction of the dikes could result in localized construction traffic, noise, and air quality impacts in the vicinity. These impacts would be temporary and would not conflict with adjacent land uses. Drying of the dredged materials would require the periodic use of earthworking equipment onsite. Impacts on adjacent land uses during the sediment drying process would be intermittent and would not conflict with existing uses in the vicinity.

Disposal of dredged sediment at the Galbraith Golf Course site would require additional permits or approvals. The site is within the area subject to the Alameda County Airport Land Use Policy Plan. As such, the project must be consistent with the General Referral Area, Height Referral Area, Noise Zone, and Safety Zone portions of the plan. The Galbraith proposal is subject to Airspace review by the FAA. The FAA has determined that the proposed project will have no impact on existing or proposed FAA facilities (Rodriquez 1994). A 4(f) Statement was prepared pursuant to the requirements of the Department of Transportation (DOT) Act, 49 U.S.C. 303, and is included in Appendix I. Also, authorization for the discharge of levee fill and dredged material must be obtained from the Army Corps of Engineers under Section 404 of the CWA. In addition, permits may be required from the Bay Area

Air Quality Management District for the pumps associated with pumping the dredged material to the site. Any decanted water from the dredged material must meet the requirements of the Regional Water Quality Control Board for discharges into San Francisco Bay and of the NPDES permit for site construction activities and operations.

5.3.6.3 Mitigation Measures

- Under an MOU between the Port and City of Oakland, the two agencies shall develop and implement a plan to mitigate the loss of golfing opportunities for Oakland senior and youth golfers during the period when the Galbraith course is not available.

- Youth Golfers. The youth golf program will be allowed to continue at Galbraith. The primary practice location will be the driving range that will remain while the dredged material project is underway. The City of Oakland will arrange with managers of other courses in the vicinity to allow the youth access to those courses on a basis similar to the access they currently have at Galbraith on Saturday afternoons.

Because the impact on the Junior Golf Program has been identified as an environmental justice issue, the Corps as the lead federal agency shall monitor the planning and implementation of the mitigation plan for youth golfers, and the Corps shall ensure that every reasonable effort is made to minimize impacts on the Junior Golf Program.

- Senior Golfers. The City of Oakland in concert with the Port of Oakland is negotiating with a local municipal golf course operator to provide subsidies for greens fees for all members of the three Galbraith seniors golf clubs and all other Oakland resident seniors who are users of the Galbraith facility.
- The Port shall construct a new golf course at the end of the dredged sediment drying phase, which will be managed by the City of Oakland as a municipal course.
- To mitigate the loss of soccer opportunities at the Galbraith field, the City of Oakland will construct a new soccer field at the Curt Flood Sports Complex in East Oakland.

5.3.7 Port/Landfill

5.3.7.1 Affected Environment

The Ninth Avenue Terminal provides breakbulk, steel, and limited container services to five shipping lines. The total terminal area, excluding the berth area, is about 26 acres. About 7 acres are occupied by covered storage structures, with the remaining area used primarily for uncovered storage. Approximately 9.2 acres of the uncovered storage area adjacent to the Inner Harbor and east of Clinton Basin is currently used for the receiving, sorting, and short-term storage of steel pipe. This site is proposed to be used for the temporary drying and rehandling of any dredged material required by the RWQCB to be disposed in a landfill to be confined prior to transport to its ultimate disposal site. The Ninth Avenue Terminal lies across the estuary from Marina Village and Encinal terminals in the City of

Alameda. The relationship of the proposed rehandling facility to these and other selected shoreline facilities in Alameda is described in Appendix F.

5.3.7.2 Project Impacts

The use of proposed temporary rehandling facility if required would further the Port's shipping mandate, consistent with the Oakland General Plan land use designation of Port-Related Uses and the Port Shoreline Plan land use designation of Shipping. The Ninth Avenue Terminal is located within the jurisdiction of the BCDC and, thus, the proposed use will require a BCDC permit and/or consistency review or certification. The proposed use is consistent with the San Francisco Bay Area Seaport Plan, which designates the Ninth Avenue Terminal as a port priority use area, and which allows interim uses. Interim uses are typically less than five years and must be readily displaceable when the area is needed for marine terminals or directly related ancillary activities. No changes are necessary to pilings that support the Ninth Avenue Terminal and no fill permit would be required. The proposed temporary use would not have a significant impact on the visual characteristics of the Ninth Avenue Terminal or the Port shoreline.

5.3.7.3 Mitigation Measures

No mitigation measures are required.

5.3.8 Montezuma Wetlands

5.3.8.1 Affected Environment

The Montezuma Wetlands site is presently leased for three uses. The northern third of the site is used as a hunting club for duck and pheasant. The site is also used for cattle grazing. A small area at the southeast end of the site adjacent to the McDougal Cut is leased to the Jerico Towing Company, which brings oyster shells and sand to the site. The material is processed and sold for construction purposes. In addition, the California Department of Water Resources (CDWR) has a day-use area for recreational fishing, boating, and picnicking on Montezuma Slough. The DWR day-use area is used primarily by local residents who come to fish off the pier and use the area for picnicking. Approximately 600 to 700 people use the area each year. The Montezuma Wetlands project would fill the eastern half of the site with dredged materials and create wetlands. The grassland environment would be eliminated along with the associated recreational hunting uses. Grazing also would be eliminated on about 150 acres below 10 feet in elevation. Proposed improvements to the DWR day-use area and wetland enhancements would be a benefit to recreational fishing and other recreational uses, although these uses would be disrupted temporarily during construction (Solano County 1993). Because the number of potentially affected users is small, impacts are not considered significant.

Several residences are adjacent to the site along Collinsville Road, and a small cluster of about eight to ten residences is located near Collinsville Road and Fire Truck Road. One small settlement, Collinsville, lies west of the McDougal Cut on the Sacramento River. The town of Bird's Landing lies to the northeast of the site. Land to the east of Collinsville Road in the Montezuma Hills is used for sheep and cattle grazing. Land across Montezuma Slough to the west of the site within the Suisun Marsh is used for hunting and wildlife habitat production.

Use of the site is directed by the plans of several local, state, and federal agencies. The relevant local plans are the *Solano County General Plan*, *Collinsville-Montezuma Hills Area Plan and Program*, and the *Solano County Local Protection Plan (LPP)*. The BCDC has three plans that apply to the project site: the *Suisun Marsh Plan*, the *Solano County Local Protection Plan*, and the *San Francisco Bay Plan*. The San Francisco Bay RWQCB's *Basin Plan* also applies to the project.

5.3.8.2 Project Impacts

The applicants for the Montezuma Wetlands project are requesting an amendment to policies contained in several elements of the *Solano County General Plan (Land Use and Circulation Element, Resource Conservation and Land Use Element, and Collinsville-Montezuma Hills Area Plan and Program)*. In addition, an amendment to the Zoning Ordinance has been requested. The proposed amendments would allow for use of dredged spoils to restore wetlands on the western half of the site. The changes would specifically identify dredged materials as appropriate fill material for creation of the wetland areas. Similar amendments have been proposed to the BCDC's *Suisun Marsh Protection Plan and LPP*. The amendments would allow placement of dredged material in the low-lying areas of the primary management area on the western half of the site to create wetlands and would allow marsh enhancement in the Water-Related Industrial and Port Priority Use Area on the eastern half of the site. Although not requested, it appears that the project also would require similar changes to the policies in the *Bay Plan*, *Seaport Plan*, and federally approved Coastal Zone Management Program (Solano County 1993).

Potential land use impacts and policy inconsistencies were noted in the administrative draft EIR/EIS prepared for the Montezuma Wetlands Project (Solano County 1993). However, if this disposal site is selected, it is assumed that appropriate plan and policy amendments will be in place, and that the land use impacts will be mitigated to the extent feasible through the environmental review and permit process. If dredged material from the proposed project were to be disposed at this facility, it would be consistent with the facility's permitted use. Potential land use impacts would result from conversion of the site to a disposal site, an action that is separate from the proposed Oakland Harbor deepening project. Therefore, land use impacts would be addressed fully in the EIR/EIS for the Montezuma Wetlands Project, being prepared by Solano County, not the SEIR/S for the Oakland Harbor project.

5.3.8.3 Mitigation Measures

No mitigation measures are required.

6.0 PROJECT ALTERNATIVES ANALYSIS

This chapter summarizes the potential environmental impacts of the No-Action Alternative and the 12 disposal alternatives, by resource area. The impacts of the No-Action Alternative are presented first (section 6.1), followed by a summary comparison of the 12 disposal alternatives (section 6.2). A detailed description of the potentially significant impacts of the 12 disposal alternatives is presented in Appendix G. All the impacts, including adverse but insignificant impacts, associated with the use of each disposal site are described in chapters 4 and 5. As explained in section 4.7, where impacts to socioeconomic resources occur that could be considered direct effects on the environment (e.g., loss of a recreational use), then impacts are summarized under land use.

6.1 NO-ACTION ALTERNATIVE

The No-Action Alternative is described in section 2.3 and its impacts are summarized below. Some general statements can be made for all the environmental resources. Insofar as maintenance sediments suitable for unconfined aquatic disposal would be disposed only at aquatic sites, maintenance dredging would have no currently anticipated impact on upland resources. Several of the sites would likely still be used for disposal of some dredged materials, including the Ocean Section 102 site, Alcatraz, Sonoma Baylands, Montezuma Wetlands, and perhaps Leonard Ranch. Thus impacts at these sites for all resources could be similar to those for the proposed project, although the impacts could be less if they received less dredged material without the proposed project. Impacts at Galbraith Golf Course associated with dredged material disposal would not occur under this alternative, and recreational resources at this site would continue to be available to the community. Impacts from dredged material disposal at the Ninth Avenue Marine Terminal site associated with the Port/Landfill disposal option would not occur, as this site would continue as a cargo terminal for break bulk cargo. Any impacts at the four landfills associated with dredged material disposal from the proposed project (Redwood Landfill, West Contra Costa Sanitary Landfill, BFI Vasco Road Sanitary Landfill, and East Carbon Development Corporation Landfill) would not occur. All the potential impacts associated with the proposed project are described in chapters 4 and 5.

6.1.1 Air Quality

The No-Action Alternative assumes that the project would not be implemented. As a result, proposed deepening activities at the Port of Oakland and their associated air quality impacts would not occur. On a short-term basis, air quality impacts from existing maintenance dredging would be similar to those identified for project dredging. Air quality impacts similar to those identified for project disposal activities could also occur at several of the disposal sites, assuming that other dredging activities within the region require sites to dispose of dredging spoils.

Without the proposed channel deepening, a potential reduction in emissions in the region would not occur. Due to the proposed channel deepening, future cargo throughput per ship visit would increase. As a result, fewer ships would be required to transport the same amount of cargo compared to the existing fleet. Although these ships would generate more emissions per ship visit than existing ships, fewer emissions would be produced over the long term for a given amount of cargo. The main reasons for this are that a decreased number of ship visits would eliminate a substantial amount of emissions from two sources: (1) cargo ships due to cruising and maneuvering activities, and (2) tugboat assistance. In

1 addition, a deeper channel would enable ships to more easily traverse the Harbor, thereby reducing
2 queuing times and the associated emissions during low-water stages. The proposed channel deepening
3 would therefore decrease the amount of emissions produced per unit of cargo throughput.
4

5 **6.1.2 Hydrology, Groundwater, and Water Quality**

6
7 The decision to not implement the proposed navigation improvements would maintain present marine
8 water quality conditions at the dredging site and the disposal sites if the disposal sites are not used in
9 conjunction with other dredging projects. Hydrodynamic conditions, total suspended solids
10 concentrations, pH, salinity, temperature, dissolved oxygen concentrations, nutrients levels, and
11 contaminants inputs would remain the same (with respect to impacts related to this project only).
12

13 **6.1.3 Geology, Soils, and Seismicity**

14
15 The No-Action Alternative for the Oakland Harbor Deepening Project would lead to no changes in
16 current marine sediment conditions and shoaling rates at the dredging sites and aquatic disposal sites if
17 the disposal sites were not used for other dredging projects. The advantages of removing sediments at
18 the dredging site would not be realized if the No-Action Alternative were exercised. Maintenance
19 dredging of the existing harbor facilities, however, would still occur.
20

21 **6.1.4 Biological Resources**

22
23 The biological communities at both the ocean site and Alcatraz would probably continue to change since
24 both of these sites have been used for dredged material disposal in the past and would likely continue to
25 be used as disposal sites, at some level, even without the Oakland Harbor deepening project. At the
26 ocean site, the difference between the proposed action and the No-Action Alternative would be minor,
27 since the proposed action represents about one-third of the volume of material that could be
28 accommodated at the site yearly. The historical use of the Alcatraz site has resulted in a benthic
29 community that is adapted to the physical disturbance associated with dredged material disposal. Under
30 the present management program for this site, it should continue to support populations of fish, birds,
31 crabs, and marine mammals. The biological community at the Bay Farm Borrow Area would probably
32 remain unchanged, until that site were selected for dredged material disposal or some other use in the
33 future. Significant adverse impacts associated with the use of Oakland Harbor sediments to fill existing
34 wetlands would be avoided at the Leonard Ranch, Sonoma Baylands, Galbraith, and Montezuma Wetlands
35 sites. Conversely, potentially beneficial impacts of the use of Port of Oakland sediments to restore or
36 create wetlands would not occur at the Sonoma Baylands and Montezuma Wetlands sites. The Sonoma
37 Baylands and Montezuma Wetlands sites are proposed independently of the Oakland Harbor deepening
38 project, and hence could be available for sediment disposal by another project even if the No-Action
39 Alternative were selected. At these sites, however, neither the adverse impacts of dredged material
40 disposal nor the use of dredged sediments to restore wetlands would occur unless other dredged material
41 and other funding sources were used.
42

43 **6.1.5 Cultural Resources**

44
45 Under this alternative, no additional disturbances to either offshore bottom or onshore ground surfaces
46 would occur. Therefore, no impacts to potential cultural resources would occur. Maintenance dredging
47 would not increase the extent of impacts on the historic North and South Jetties within Oakland Harbor.

6.1.6 Noise

The No-Action Alternative is based on a scenario of no channel deepening to the 42-foot level, resulting in reduction in intermodal traffic, as described in section 4.8.3. Since there would be no deepening, no tugs, and decreased ship and truck traffic, there would not be any adverse noise impacts. Train lengths may also decrease under the No-Action Alternative, as discussed in section 4.8.3.

6.1.7 Socioeconomics

Without the proposed project, the projected growth in shipping activity would be slight. Port forecasts for the year 2000 without the proposed project are based on a scenario that assumes the loss of all intermodal traffic to and from east of the Mississippi River and the loss of most intermodal cargo from the Prairies Region (Port of Oakland 1992).

As shown on Table 4.7.3-1, under the low level forecast, annual business revenue, including customs revenue, for the year 2000 without the proposed project would be \$1,068.8 million, a \$126.2 million decrease from 1991 revenues, and \$254.5 million to \$639 million less than with the proposed project. Direct jobs without the proposed project would be 6,800, an increase of 100 jobs over 1991 figures, but 600 to 1,600 fewer jobs than with the proposed project. Personal income from direct jobs would be \$223.6 million, a \$3.3 million increase over 1991 income generated by direct jobs, and \$21.6 million to \$54.1 million less than with the proposed project. Induced jobs would remain the same as in 1991, which would be 300 to 700 fewer jobs than with the proposed project. Personal income from induced jobs would be \$212.4 million, a \$3.1 million increase over 1991, but \$20.5 million to \$51.4 million less than with the proposed project. Related jobs are projected to be 232,400, an increase of 62,900 over 1991, with no change in forecast with the proposed project. The Port's contribution to state, county, and local taxes without the proposed project is estimated to be \$38.8 million, an increase of \$0.5 million over 1991, but \$3.7 million to \$9.2 million less than with the proposed project.

Revenue tons handled in the year 2000 would be 16 million, a 0.2 million increase from 1991, and 4.2 to 10.6 million revenue tons less than with the proposed project. An estimated 666,000 containers would be handled, 3,000 fewer than were handled in 1991, and 196,000 to 490,000 fewer than would be handled with the proposed project. About 13 percent of containers would be sent to or from the Port by rail, a 20 percent decrease from 1991, and 20 percent to 37 percent less than with the proposed project.

It is likely that the Ocean disposal site and the Alcatraz site would be used for disposal of dredged material from other projects with no adverse socioeconomic repercussions. The future of the BFBA is unknown, although it, too, could be used in the future. The Leonard Ranch/Redwood Landfill sites could be used for a comparable purpose if the Oakland Harbor project did not go forward, as could Sonoma Baylands and the Montezuma Wetlands site. The Galbraith Golf Course would continue in its present use, as would the Ninth Avenue Marine Terminal.

6.1.8 Transportation and Circulation

The No-Action Alternative is based on a scenario of not dredging to the 42-foot level, resulting in reduction in intermodal traffic. It assumes the loss of all intermodal traffic to and from east of the Mississippi and Texas, and the loss of most intermodal cargo from the Prairies region. Table 6.1.8-1

Project Alternatives Analysis

shows the number of truck trips projected for the year 2000 without the dredging project. Negative numbers are shown in parentheses.

Table 6.1.8-1. Change in One-Way Port Truck Trips without the Project in 2000 Compared to 1991

<i>Type of Movement</i>	<i>Annual Trips</i>	<i>Average Weekday</i>	<i>Peak Day¹</i>	<i>Peak Hour²</i>
Local Truck Trips; 150-200 miles or less	235,499	645	1,290	
Intermodal Truck Moves ³ (ship-rail)	(112,818)	(309)	(618)	
TOTAL	122,681	336	672	35 in/35 out

Notes:

1. The peak day is estimated to be double the annual average daily container loading.
2. The peak-hour generation is constrained by the loading and unloading capability of the container cranes and associated equipment and gates.
3. A negative number (shown in parentheses) reflects an anticipated loss in intermodal market share to other ports on the West Coast if the dredging project does not occur.

Source:

Based on information in memorandum from Gay Joseph to Jody Zaitlin, "42' Dredging Impacts," dated March 11, 1993. Average weekday trips = annual trips divided by 365. There are two truck movements per container movement for local truck trips, and one truck movement per container movement for intermodal truck moves.

6.1.9 Land Use Plans and Policies

Without the proposed Deep-Draft Navigation Improvements project, the channel would be unable to accommodate some of the newer deep-draft vessels and Port facilities would remain below capacity. The applicable goals, policies, and recommendations of the San Francisco Bay Area Seaport Plan, the San Francisco Bay Plan, and the Regional Transportation Plan would not be fostered or implemented. The No-Action Alternative would conflict with these plans to the extent that the newer deep-draft vessels would call elsewhere, either necessitating possible dredging, Bay fill, and/or new onshore facilities in San Francisco Bay, or leaving the Bay Area altogether. Should entire shipping lines relocate to other deep-water ports, existing marine terminal and ancillary facilities at the Port would have greater unused capacity than at present. This would constitute a significant, potentially unmitigable impact on land use at the Port.

6.2 COMPARISON OF DREDGED MATERIAL DISPOSAL ALTERNATIVES

Since the dredged material disposal alternatives are comprised of different combinations of disposal sites, as explained in section 2.8, the impacts of the alternatives are based on the impacts and benefits that would occur at each site. These impacts, which have been discussed in detail in chapters 4 and 5, are summarized by site and by resource in Table 6-1. The 12 disposal alternatives are compared in Table 6-2. These tables indicate the maximum level of impact that would be expected if that disposal site were used or that alternative were implemented. The level of adverse impact in the table for a given resource is noted as: (0) negligible/no impact; (1) adverse but not significant; (2) significant but mitigable; or (3) significant and unavoidable. Beneficial impacts are categorized as either: (1) beneficial but not

substantial impact; or (2) substantial beneficial impact. Since most of the alternatives are comprised of more than one disposal site, the level of impact assigned to the alternative in Table 6-2 is based on the highest impact that could occur, even if that impact would occur at only one site in the alternative. For example, if an alternative involves three sites, each of which involves a different level of impact, the highest impact of the three sites would be assigned to the alternative.

The following summarizes information contained in, or that contributed to, tables 6-1 and 6-2.

1. **Air quality** impacts would be significant and unavoidable (a "3") during dredging and disposal activities for any of the 12 disposal alternatives selected. The project would provide for more efficient shipping in the future. The "with" project future condition would result in less emissions from cargo ships and more emissions from land-based sources that handle ship cargo, compared to the No-Action Alternative. The air quality impacts from future cargo handling at the Harbor are insignificant and thus considered negligible (a "0").
2. For **water resources**, only the alternatives involving confined aquatic disposal (D1), Sonoma Baylands, or the Galbraith Golf Course site (A1, B2, B3, C1, E1, and E2) would involve significant but mitigable impacts (a "2"). Water quality impacts for unconfined aquatic disposal would be adverse but insignificant (a "1"). All of the upland/wetland disposal options, which would receive material unsuitable for unconfined aquatic disposal, would have potential water quality impacts that would be reduced to not significant levels through mitigation and management measures. Because no "unsuitable" material would be disposed at Sonoma Baylands, water quality impacts at this site are not significant.
3. For **geology/soils**, all of the disposal alternatives except confined aquatic disposal (D1) involve significant but mitigable impacts (a "2"). It is the impacts at the *upland* sites that drive the impact level for all the alternatives. Geologic impacts at the aquatic sites would be negligible (a "0"), except at the Bay Farm Borrow Area (BFBA) under Alternative D1 (maximum confined aquatic disposal), where the impact would be adverse but not significant (a "1"). A significant beneficial impact associated with the dredging activity would be the removal of some of the contaminated sediments in Oakland Harbor.
4. For **biological resources**, there are no significant impacts associated with dredging, ocean disposal, or the disposal of sediments at the BFBA given the cell design and periodic capping plan for this site. Alternatives involving use of the Galbraith or Leonard Ranch/Redwood sites would have significant adverse but mitigable impacts on biological resources, with impacts at Galbraith substantially less than at Leonard Ranch/Redwood.

Only alternatives involving either Sonoma Baylands or Montezuma Wetlands (B1 through B3; C1 and C2) could have a beneficial impact on some biological resources due to wetlands restoration. Dredged material disposal at the Sonoma Baylands site would have adverse but mitigable impacts as a result of the disturbance or loss of existing biological resources. At this site, however, there would be beneficial impacts

Table 6-1. Comparison of Dredged Material Disposal Sites¹

Disposal Site	Air Quality	Water Resources	Geology and Soils	Biological Resources	Cultural Resources	Noise	Transportation	Land Use²	Human Health Risk
Ocean Section 102 Site	-3	-1	-0	-1	-0	-0	-0	-0	-0
Alcatraz	-3	-1	-0	-1	-0	-0	-0	-0	-0
Bay Farm Borrow Area	-3	-2	-1	-1	-0	-0	-0	-0	-0
Leonard Ranch/ Redwood Landfill	-3	-2	-2	-2	-1	-0	-2	-3	-1
Sonoma Baylands	-3	-1	-1	+2	-0	-1	-0	-0	-0
Galbraith Golf Course	-3	-2	-2	-2	-0	-2	-0	-3	-1
Port/Landfill	-3	-2	0	0	-0	-1	-0	-1	-1
Montezuma Wetlands	-3	-2	-2	+2/-3	-2	-2	-0	+1	-0

Notes

1. A number preceded by a minus sign (-) is an adverse impact. A number preceded by a plus sign (+) is a beneficial impact.

For adverse impacts:

- 3 = significant and unavoidable adverse impact
- 2 = significant but mitigable adverse impact
- 1 = adverse but not significant impact
- 0 = negligible or no impact

For beneficial impacts:

- 2 = substantial beneficial impact
- 1 = beneficial but not substantial impact

2. For land use, the number in the table refers to compatibility with existing land uses. A plus (+) after the number = consistency with plans and policies, a minus (-) after the number = potential inconsistency.

Table 6-2. Comparison of Project Alternatives¹
(page 1 of 2)

Project Component	Air Quality	Water Resources	Geology and Soils	Biological Resources	Cultural Resources	Noise	Transportation	Land Use ²	Plans and Policies ³	Human Health Risk
Dredging Activity	-3	-1	0/+2	-1	0	0	+2	-0	+	-0
No-Action Alternative	0	0	0	0	0	0	0/+1	-3	-	-0
Maximum Ocean Disposal										
A1. Ocean, Galbraith	-3	-2	-2	-2	-0	-2	-0	-3	+	-1
A2. Ocean, Leonard	-3	-2	-2	-2	-1	-1	-2	-3	-	-1
Maximum Wetland Restoration										
B1. Ocean, Montezuma, Port	-3	-2	-2	-3/+2	-2	-2	-0	-1/+1	+	-1
B2. Ocean, Sonoma, Galbraith	-3	-2	-2	-2/+2	-0	-2	-0	-3	+	-1
B3. Ocean, Leonard, Sonoma	-3	-2	-2	-2/+2	-1	-1	-2	-3	-	-1
All Upland Disposal										
C1. Galbraith, Montezuma	-3	-2	-2	-3/+2	-2	-2	-0	-3/+1	+	-1
C2. Leonard, Montezuma	-3	-2	-2	-3/+2	-2	-2	-2	-3/+1	-	-1
D1. Maximum Confined Aquatic Disposal Borrow Area	-3	-2	-1	-1	-0	-1	-0	-1	-	-1
Maximum In-Bay Unconfined Aquatic Disposal										
E1. Ocean, Alcatraz, Galbraith	-3	-2	-2	-2	-0	-2	-0	-3	-	-1
E2. Ocean, BFBA, Galbraith	-3	-2	-2	-2	-0	-2	-0	-3	-	-1
E3. Ocean, Alcatraz, Leonard	-3	-2	-2	-2	-1	-1	-2	-3	-	-1
E4. Ocean, BFBA, Leonard	-3	-2	-2	-2	-1	-1	-2	-3	-	-1

6-7

Table 6-2. Comparison of Project Alternatives¹
(page 2 of 2)

Notes

1. A number preceded by a minus sign (-) is an adverse impact. A number preceded by a plus sign (+) is a beneficial impact. A slash mark (/) separates an adverse impact from a beneficial impact.

For adverse impacts: 3 = significant and unavoidable adverse impact
 2 = significant but mitigable adverse impact
 1 = adverse but not significant impact
 0 = negligible or no impact

For beneficial impacts: 2 = significant beneficial impact

2. Land use refers to actual physical impacts (e.g., loss of recreational uses or loss of prime farmland).
3. For plans and policies, the plus (+) or minus (-) in the table refers to potential consistency or inconsistency with existing applicable land uses plans and policies. A plus (+) = consistency with plans and policies, a minus (-) = potential inconsistency.

more than adequate to offset the loss of existing wetlands, as a result of tidal wetlands restoration. Development of Phase I of the Montezuma Wetlands Project would have significant adverse impacts on existing wetlands habitat and sensitive species, as well as substantial beneficial impacts of tidal wetlands restoration. As yet, it is uncertain whether site development impacts are fully mitigable to less than significant levels, however. For this reason, the three alternatives involving Montezuma Wetlands (B1, C1, and C2) are assigned significant unavoidable adverse impacts in Table 6-2.

The alternative that has the lowest adverse impacts combined with the greatest beneficial impacts is B2, involving use of the Sonoma Baylands and Galbraith sites, in combination with ocean disposal; a slightly less preferable alternative is B1, which entails use of the Montezuma site in combination with ocean disposal; and C1, combining Montezuma and Galbraith.

5. For **cultural resources**, alternatives using the Montezuma Wetlands site potentially would have significant but mitigable impacts (a "2"); all other alternatives would have essentially no impact, except the alternatives involving Leonard Ranch where there is the potential for cultural resources to be present. The significant but mitigable impacts on the Montezuma Wetlands site are due to the presence of several potentially significant prehistoric and historic cultural resources, only two of which are located on the Phase I disposal area (according to the applicant for the Montezuma Wetlands Project). The Leonard Ranch site has not been surveyed for the presence of cultural remains, although several known sites are in the vicinity. This suggests that similar types of sites could exist at Leonard Ranch. The potential for encountering currently unknown cultural resources during construction at Sonoma Baylands, Galbraith, and aquatic disposal sites is negligible due to previous land use activities and disturbances (except for the Ocean Section 102 site, which is too deep for any Early Holocene prehistoric occupation and too distant from the coast for any historic shipwreck).
6. For **noise**, no impacts were associated with the ocean disposal site, the in-Bay sites, or Leonard Ranch/Redwood Landfill. The unloaders and/or pumps would cause significant but mitigable impacts (a "2") for any alternatives involving Galbraith or Montezuma Wetlands. Noise impacts at Sonoma Baylands and Port/Landfill would be adverse but not significant (a "1").
7. For **transportation**, the only significant but mitigable impacts (a "2") were associated with ground transportation to Redwood Landfill; there were no significant impacts associated with vessel transportation. The beneficial impact in Oakland Harbor would be more efficient and safer vessel transportation because existing delays due to tides would be minimized. The beneficial impact of the No-Action Alternative would be reduced vessel trips and reduced intermodal traffic.
8. For **land use**, significant visual impacts that may not be mitigable to insignificance (a "3") are expected for any of the alternatives that involve Leonard Ranch (A2, B3, C2, E3, and E4). Temporary significant, unavoidable impacts on recreation (a "3") would occur for alternatives that involve Galbraith Golf Course (A1, B2, C1, E1, and E2) due

1 to lost golfing opportunities. Minor beneficial impacts would occur from improvement
2 of the on-site day use area at Montezuma Wetlands.

- 3
- 4 9. For **plans and policies**, nine of the alternatives would have inconsistencies with land
5 use plans or policies. Any alternative that involves in-Bay disposal, i.e., Alcatraz or
6 BFBA (D1 and E1 through E4), would be inconsistent with BCDC policies against
7 disposing of dredged materials in San Francisco Bay, unless disposal at ocean and
8 upland sites is proven infeasible. If in-Bay disposal is the only feasible option, then
9 use of the Alcatraz site would be potentially consistent with BCDC policy, since it is
10 a Corps-identified, in-Bay disposal site. However, use of the BFBA would be
11 considered inconsistent with BCDC policies, even if disposal at ocean and upland sites
12 is not feasible, because the site is not a LTMS-designated, in-Bay disposal site.
- 13
- 14 10. For **human health risks**, adverse but not significant health risks are anticipated for
15 residents and workers in the vicinity at any of the upland disposal sites. No increased
16 health risks are anticipated for dredged material workers at any of the upland sites as
17 long as standard handling practices are employed.

7.0 RECOMMENDATIONS

7.1 THE ENVIRONMENTALLY PREFERRED ALTERNATIVE (CEQA)

The identification of the environmentally preferred alternative in this section builds upon the discussion and analysis presented in Chapter 6 and, in particular, Table 6-2. The environmentally preferred alternative is Alternative B2, followed by Alternative A1. The reasoning for this determination is explained below.

From an environmental perspective, the No-Action Alternative is the best alternative for most environmental resources analyzed. However, selection of the No-Action Alternative would mean that the objective of deepening and widening Oakland Harbor to accommodate modern deep-draft vessels safely, efficiently, and cost-effectively would not be realized. Shipping losses would be expected to continue, substantial business revenues would not be realized, and the potential for vessel collisions and groundings would not be reduced.

None of the dredging and disposal alternatives would avoid significant impacts, since the air quality impacts associated with dredging and dredged material transport under each alternative cannot be mitigated to insignificance by feasible measures. The only other resources that could experience unavoidable significant impacts are biology, recreation (temporary), and visual resources (both of which are considered under land use). It is uncertain at this time whether the significant impacts on existing wetlands habitat and sensitive species at the Montezuma Wetlands site would be fully mitigable to less than significant levels. And, there is uncertainty as to whether a significant visual impact at Leonard Ranch (discussed in chapter 5 and Appendix F) could be mitigated to insignificance. Impacts on golf course availability would occur during the 7-year period when the Galbraith Golf Course would be used as a disposal site.

The impact levels in Table 6-2 suggest that, if all the 12 disposal alternatives and 10 resources are considered equally, no one alternative stands out as clearly the environmentally preferred alternative (i.e., none of the disposal alternatives has a preponderance of "0s" or "1s" in Table 6-2, which would reflect minimal impacts for most of the resources). Comparing 12 alternatives across 10 resources is a complex task. The process to determine an environmentally preferred alternative can be simplified if some of the alternatives, sites, or resources can be eliminated, with reason, from further consideration.

If the alternatives that involve in-Bay disposal at a new disposal site are eliminated from further consideration because this would violate San Francisco Bay Conservation and Development Commission (BCDC) policies, then the Bay Farm Borrow Area would be eliminated and three alternatives would thus drop out: alternatives D1, E2, and E4. This leaves nine remaining alternatives: the "A," "B," and "C" alternatives, as well as E1 and E3. These nine alternatives would have comparable impacts on three resources: air quality (unavoidable significant impacts), geology/soils (significant but mitigable impacts), and human health risk (adverse but not significant impacts). These three resources are thus not a basis for discriminating among these alternatives.

The alternatives that involve the Alcatraz disposal site (E1 and E3) can be eliminated from this analysis because disposal of the volume of dredged material from the proposed project that would go to this site (4.8 mcy) could jeopardize the ability of the site to accommodate the disposal requirements from

Recommendations

1 maintenance dredging of existing navigation channels. With elimination of the Alcatraz site, only the A,
2 B, and C alternatives would then remain. The A, B, and C alternatives include varying combinations
3 of five sites: the ocean site, Leonard Ranch, Sonoma Baylands, Galbraith Golf Course, and Montezuma
4 Wetlands. No significant impacts are expected at the ocean site for any resource except air quality, so
5 eliminating this site from further consideration would not represent a significant environmental benefit.
6 In the effort to identify the environmentally preferred alternative, there are, however, reasons to eliminate
7 some of the upland sites from further consideration.

8
9 There are valid reasons for eliminating alternatives that include Montezuma Wetlands. There are
10 significant potentially unmitigable biological impacts at Montezuma, where use of the Phase I portion of
11 that site would replace 576 acres of existing jurisdictional seasonal wetlands (mostly grassland) with 315
12 acres of tidal saltmarsh wetlands, and cause numerous other significant biological impacts. Furthermore,
13 the feasibility and effectiveness of the proposed mitigation measures for this site are unknown. In
14 addition, two historic archaeological sites would be impacted by development of the site. With
15 Montezuma Wetlands thus screened out, this would eliminate alternatives B1, C1, and C2.

16
17 Eliminating these three alternatives would leave four alternatives: A1, A2, B2, and B3. All four
18 alternatives would use the ocean site. The difference among these alternatives is the use of Leonard
19 Ranch, Sonoma Baylands, and Galbraith. Compared to Sonoma Baylands and Galbraith, the Leonard
20 Ranch/Redwood Landfill disposal option would have greater impacts on transportation and, potentially,
21 on cultural resources should unrecorded cultural resources be found and disturbed. There would be a
22 significant visual impact associated with Leonard Ranch that may not be mitigable to insignificance.
23 Construction of the proposed rehandling facility at Leonard Ranch would require the State Coastal
24 Conservancy Board to approve an amendment to the Sonoma Baylands Enhancement Plan which currently
25 designates the site for either muted tidal/seasonal wetlands or agricultural use. The proposed rehandling
26 facility would also be inconsistent with the General Plan's policy to avoid conversion of lands in
27 agricultural use. Other disadvantages of Leonard Ranch include concerns by the Marin Audubon Society
28 about loss of seasonal wetlands, and institutional concerns represented by Sonoma County staff and
29 officials about the need to mitigate the loss of open space. With Leonard Ranch thus screened out, this
30 would eliminate alternatives A2 and B3.

31
32 Eliminating these two additional alternatives would leave only two other alternatives: A1 and B2. Both
33 of these alternatives involve use of the ocean site and Galbraith. The difference between these two
34 alternatives is that Alternative B2 also includes Sonoma Baylands. While there would be some impacts
35 associated with this site, the development of Sonoma Baylands using dredged material would result in the
36 restoration of 289 acres of tidal marsh and 24 acres of seasonal wetland. With the significant reduction
37 in wetlands in the San Francisco Bay Area over the past many years, this is considered a substantial
38 beneficial impact, and thus makes Alternative B2 preferable to Alternative A1. Alternative B2 is thus
39 the environmentally preferred alternative. Alternative B2 involves the use of three disposal sites: the
40 ocean site, Sonoma Baylands, and Galbraith Golf Course. It is one of five alternatives (the B and C
41 alternatives) that would result in substantial beneficial impacts on biological resources due to wetlands
42 restoration.

43
44 From the above rationale, Alternative A1 would be the second most environmentally preferred alternative.
45 This alternative (which involves the ocean site and Galbraith), however, does *not* include wetland
46 restoration.

7.2 THE ENVIRONMENTALLY PREFERABLE, FEASIBLE ALTERNATIVE (NEPA)

7.2.1 Selection of the Least-Cost Plan that Can Be Implemented

Following an extensive formal and informal public and agency coordination process, the Corps has eliminated from further consideration the dredged material disposal alternatives that include disposal at the Bay Farm Borrow Area and Alcatraz. These alternative dredged material disposal sites are eliminated from further consideration on the basis that they cannot be implemented within the project time frame. The Bay Farm Borrow Area and Alcatraz site would be inconsistent with existing San Francisco Bay Conservation and Development Commission policies that prefer other alternatives in lieu of in-Bay disposal. After coordination specific to the consideration of the Bay Farm Borrow Area site conducted by the Corps' San Francisco District, other resource agencies (e.g., EPA, NMFS, USFWS, BCDC, RWQCB, and California Department of Fish and Game), by letter, declared the need for additional detailed studies prior to their consideration of the Bay Farm Borrow Area site as a viable candidate disposal site for the authorized project. Management of the Alcatraz disposal site, by the Corps of Engineers, gives preference to disposal of dredged material from the maintenance dredging of existing navigation channels. Given the large volume of material to be dredged for the deepening of the Oakland Harbor channels, disposal of this material at Alcatraz could jeopardize the ability of this site to accommodate the maintenance dredging disposal requirements of existing navigation channels.

Eliminating the Bay Farm Borrow Area and Alcatraz disposal sites from further consideration effectively eliminates the following dredged material disposal alternatives from further consideration: D1, and E1 through E4. Of the remaining dredged material disposal alternatives, the least-cost, environmentally acceptable alternative is A1 (ocean and Galbraith). Therefore, Alternative A1 is designated the least-cost plan that can be implemented. Table 7.2.1-1 summarizes the total estimated costs associated with each disposal alternative.

7.2.2 Selection of a Plan that Includes Habitat (Wetland) Restoration

While Alternative A1 is the least-cost, environmentally acceptable plan that can be implemented, the dredged material from the project is also a resource that can be used for habitat restoration, specifically wetlands. Since wetland restoration would provide substantial beneficial habitat values, in addition to addressing commercial navigation needs, consideration of a dredged material disposal alternative that includes habitat (wetland) restoration is justified. The least-cost plan that includes habitat restoration is Alternative B2 (ocean, Sonoma Baylands and Galbraith).

7.3 THE SELECTED PLAN

The habitat restoration benefits of the least-cost plan, which includes habitat restoration, would result in a substantial increase in wetland habitat of national importance. In accordance with Section 907 of the Water Resources Development Act (WRDA) of 1986, monetary benefits attributable to measures included in a project for the purpose of habitat restoration or enhancement shall be deemed to be at least equal to the costs of such measures.

Given the provision of WRDA 1986 (i.e., benefits exceed costs for justifiable habitat restoration), the selected plan is dredged material disposal Alternative B2 (i.e., ocean, Sonoma Baylands, and Galbraith). Alternative B2 is therefore designated as the National Economic Development (NED) plan.

Table 7.2.1-1. Total Estimated Costs Associated with Each Dredged Material Disposal Alternative

Disposal Alternative ¹	Estimated Total Cost (\$ in millions) ²
Maximum Ocean Disposal	
A1. Ocean and Galbraith	\$116.6
A2. Ocean and Leonard Ranch/Redwood Landfill	\$141.2
Maximum Wetland Restoration	
B1. Ocean, Montezuma Wetlands, Port/Landfill	\$151.3
B2. Ocean, Sonoma Baylands, Galbraith	\$143.4
B3. Ocean, Sonoma Baylands, Leonard Ranch/Redwood Landfill	\$169.3
All Upland Disposal	
C1. Montezuma Wetlands, Galbraith	\$157.2
C2. Montezuma Wetlands, Leonard Ranch/Redwood Landfill	\$155.1
Maximum Confined Aquatic Disposal	
D1. Bay Farm Borrow Area	\$ 80.2
Maximum Unconfined Aquatic Disposal	
E1. Ocean, Alcatraz, Galbraith	\$ 98.2
E2. Ocean, Bay Farm Borrow Area, Galbraith	\$ 99.8
E3. Ocean, Alcatraz, Leonard Ranch/Redwood Landfill	\$124.2
E4. Ocean, Bay Farm Borrow Area, Leonard Ranch/Redwood Landfill	\$125.7

- Note:
1. Use of the Port/Landfill disposal option as part of any disposal alternative would occur only if required by the RWQCB.
 2. Does not include approximately \$16 million additional cost for site preparation, land value, and improvement to the existing golf course at the Galbraith site for any alternative that includes disposal at the Galbraith site.

Source: U.S. Army Corps of Engineers, San Francisco District (October 1993 price level), revised November 15, 1993.

8.0 UNAVOIDABLE SIGNIFICANT IMPACTS

Dredging operations at the Oakland Harbor would result in unavoidable significant adverse air quality impacts, since NO_x emissions would not be feasibly mitigated to below the Bay Area Air Quality Management District (BAAQMD) Best Available Control Technology (BACT) emission significance threshold during this activity. The main sources of emissions would be diesel-powered dredges. However, these emissions would be temporary and cease at the end of the two-and-a-half-year construction period.

The preferred disposal alternative is Alternative B2, which involves disposal of dredged material at the ocean site, Sonoma Baylands, Galbraith and, if required by the RWQCB, Port/Landfill. The only unavoidable significant impacts with this alternative would be on air quality and recreation (temporary). Disposal activities from this alternative would exceed BAAQMD emission significance thresholds for all pollutants. Daily project emissions would exceed one percent of the combined NO_x emissions from Alameda, San Francisco, and Sonoma counties, and the daily BACT trigger levels for all pollutants. Feasible mitigation measures would reduce project emissions, but not to insignificance (except SO₂). The main source of emissions from this alternative would be tugboats. However, these emissions would be temporary and cease at the end of disposal activities. Loss of the Galbraith Golf Course during disposal activities would reduce public golfing opportunities until the facility could be rebuilt at the same location.

Unavoidable Significant Impacts

9.0 GROWTH-INDUCING IMPACTS

The primary purpose of the proposed 42-foot deep-draft navigation improvement project is to enhance existing levels of shipping by allowing modern containerships, which currently are calling at the Port of Oakland, to operate with greater safety and efficiency. In the last few years, the Port has suffered a loss of loading capacity and business to other West Coast ports with deeper water (Port of Oakland 1993). The proposed project is expected to stop further shipping losses and to return the Port of Oakland to its previous competitive position with respect to other West Coast ports in Southern California and Puget Sound. Current market share is approximately 10 percent of West Coast discretionary intermodal cargo. Estimates of market share of this cargo after completion of the deepening project range from 10 to 25 percent. Under the No-Action Alternative as described in section 2.3, market share of this cargo could eventually drop to 0 percent.

Current Port clients have modernized their containership fleets to more efficient, higher capacity "Panamax" (Third Generation) and "Post Panamax" (Fourth Generation) class ships. The retention of these existing clients requires that the Port continue to improve its facilities. It is anticipated that as a result of this project, the number of first and last ports-of-call would increase and that by the year 2000, the Port's annual revenue tons would increase by an amount ranging from 3.1 percent (medium-level forecast) to 5.9 percent (high-level forecast) over the 1990 base year of approximately 15 million revenue tons. With the proposed project, by the year 2000, annual business revenue is projected to increase by an amount ranging from \$128.3 million to \$512.8 million. Direct and induced jobs are projected to increase by an amount ranging from 1,000 to 2,400 as a result of the project (Port of Oakland 1992; see Table 4.7.3.1-1). It should be noted that these economic growth projections are prepared by the Port and their accuracy is influenced by variables such as macroeconomic factors, commodity shipping patterns, and marketing efforts, as well as the proposed deep-draft navigation improvement project. Because of these variables, the proposed project alone would not guarantee an increase in cargo.

Should containership terminal operations at the Port increase to the capacity currently permitted by the existing facilities and improvements, on-shore activities such as freight-handling, trucking, and intermodal rail services would also likely increase. Any demands for additional employees resulting from these activities can be expected to be met by the local population, as construction contractors and employers are required to comply with the Port's Equal Opportunity and Affirmative Action policies regarding local hiring. The proposed project is not expected to result in any reasonably foreseeable population or housing growth in the project area.

Should the improvements provided by the proposed project result in growth in maritime trade that necessitates expansion or construction of major new facilities or infrastructure improvements beyond the currently planned capacity, additional environmental review would be required.

10.0 CUMULATIVE IMPACTS

Potential cumulative impacts of the proposed Deep-Draft Navigation Improvement Project involve both regional and local considerations. Within the regional context, the proposed project would be part of the ongoing dredging and disposal activities required for the maintenance and improvement of commercial ports, public and private marinas, and flood control facilities in and around San Francisco Bay. In a local context, the proposed project would be one of a number of projects that the Port of Oakland is planning or carrying out within its jurisdictional boundaries in order to remain a competitive West Coast port. Additionally, the local context would include other projects in the vicinity of the Port and the disposal sites included in the tentatively selected plan.

10.1 REGIONAL CONSIDERATIONS

Dredging projects in the San Francisco Bay Area have been a necessary activity to provide adequate and safe navigation for waterborne commerce. Dredging will continue to be required to maintain existing channel and berthing facilities, as well as improvement dredging and new projects, to ensure that the Bay Area ports remain competitive. Several agencies and commercial operators are responsible for the maintenance and improvement of the area's facilities. The U.S. Navy and the U.S. Army Corps of Engineers (Corps) are the major entities performing dredging projects. Other entities performing dredging include commercial ports (e.g., Port of Oakland, Port of San Francisco), marinas, and flood control districts.

The volume of dredged material in the Bay Area averaged 7.3 mcy per year for 1986 and 1987 (EPA 1993a). An estimate of future dredging in the Bay Area for various projects including the Corps, U.S. Navy, Port of Oakland, and other permitted dredging projects is provided in Table 10.1-1. An estimated disposal volume of 44 mcy of dredged material would be required through 1995 if all projects are completed. The proposed Oakland Harbor Deep-Draft Navigation Improvement Project would represent approximately 15 percent of the estimated total disposal volume during this time frame.

Disposal of dredged material for the projects identified in Table 10.1-1 assumes use of ocean, San Francisco Bay, and upland disposal sites. Currently, the only ocean site available for region-wide dredged material disposal is the San Francisco Bar site. This site is limited to sandy materials only, and materials typical of the projects listed would not be suitable for disposal at the Bar site. The designation of an additional ocean disposal site is anticipated in mid 1994. The only site currently approved for disposal of dredged material in the southern and central portions of San Francisco Bay is the Alcatraz site. Upland sites are currently being used for limited volumes for project-specific purposes. No large capacity upland disposal sites are currently permitted for regional use.

To meet dredged material disposal requirements for the next 50 years, a Long-Term Management Strategy (LTMS) Study Plan for the San Francisco Bay region has been formulated (see section 1.5). The LTMS is a joint undertaking of four main agencies: U.S. Army Corps of Engineers; U.S. Environmental Protection Agency; San Francisco Bay Regional Water Quality Control Board; and San Francisco Bay Conservation and Development Commission. In-Bay, ocean and non-aquatic disposal options, as well as specific aspects of dredged materials reuse, are being evaluated. The policy alternatives for disposal will be undergoing environmental review beginning in 1994 (Tuden 1993).

Table 10.1-1. Potential Demand for Dredged Material Disposal, 1990-1995
(millions of cubic yards)

<i>Project</i>	<i>Volume</i>	<i>Type¹</i>
Port of Oakland		
Oakland Inner/Outer	1.8	M
Oakland - Various	0.30	N
Oakland Berth Maintenance	0.9	M
U.S. Navy		
NAS Alameda	0.42	N
NSC Oakland	0.83	N
Hunters Point	0.43	N
Various Maintenance	8.62	M
Corps of Engineers		
John F. Baldwin Ship Channel	8.00	N
Oakland Inner Harbor (38-foot)	0.56	N
Oakland Inner and Outer Harbor (42-foot) ²	6.6	N
Oakland Inner and Outer Harbor	see Port of Oakland	N
Federal Channel Maintenance	7.81	M
Other		
Maintenance	9.3	M
Total Potential Demand	44.77	

Notes:

1. M = Maintenance dredging projects.
N = New dredging projects.
2. This is the proposed project that is the subject of this SEIR/S.

Data presented are for various timeframes (e.g., 1989-1992, 1991-1993, etc.). Data are projections and may not represent all potential dredging during the 1990-1995 time period; therefore, total potential demand should be considered a minimum demand.

Sources:

Corps, Port of Oakland, EPA, 1990.

From an initial screening of about 80 candidate land disposal sites and six different dredged materials disposal options, the LTMS lists 12 sites (15 potential projects) that are considered to be highly feasible as regional disposal/rehandling sites during the 50-year planning timeframe (Table 10.1-2). In addition to the sites listed in the table, the existing Petaluma River disposal site has recently been included as a potential, highly feasible site. All highly feasible projects are located adjacent to San Pablo Bay or Suisun Bay (Figure 10.1-1). The potential total dredged sediment disposal capacity of the highly feasible sites is shown below (Moffatt & Nichol 1993).

<u>Disposal Option</u>	<u>Total Estimated Capacity (millions of cubic yards)</u>
Confined Disposal	9 to 54
Reprocessing	9 to 14 (holding volume, not throughput)
Habitat Development	60
Landfill Cover	5

Given the conceptual level of detail currently available on the highly feasible sites identified by the LTMS, their potential disposal capacity is not further quantifiable at this time.

Potential cumulative impacts on a regional basis could include increased air pollution, increases in the volume of waterborne transportation, changes in land use, and modifications to wetland habitat.

Potential uses for dredged material at upland sites include use of sediments for general fill and construction (e.g., levee reinforcement) and wetland habitat development. Depending on the disposal method chosen, the location of the air basin and proximity of sensitive receptors to the disposal location, cumulative impacts could include incremental additions to vehicle and construction equipment exhaust emissions associated with sediment transport, handling, and disposal. However, these additions to air pollution would be short-term, localized, and not significant cumulative changes. Dredged material would be wet during transport and thus would not generate dust.

Changes in land use also could be viewed in a cumulative sense. If land currently used for agricultural production were to be used for wetland habitat development, the proposed project could incrementally contribute to reductions in productive agricultural land. However, since none of the upland disposal sites has high quality agricultural soil, there would be no reduction of prime agricultural lands. In some cases, the marginal agricultural uses of the upland sites would be replaced with tidal wetlands, a scarce and valued resource in the Bay Area.

Where upland sites contain seasonal wetlands that would be replaced by dredged materials or tidal wetlands, the cumulative impact of a net loss of seasonal wetlands would be considered significant, however this impact cannot be quantified until more definitive plans are developed for the sites identified in the LTMS. Generally, an increase in wetland habitat along the Bay margin would be a beneficial cumulative impact, replacing habitat lost from past Bay filling and diking.

It is possible that barges could be used to transport dredged material to some of the sites close to the Bay. In that case, waterborne transportation would increase. This impact cannot be quantified until more definitive plans are developed.

Table 10.1-2 Highly Feasible LTMS Disposal Sites ¹

<i>Site Name</i>	<i>Region</i>	<i>Disposal Option² Considered</i>
Cargill Salt Div - 1 (East)	San Pablo Bay	CD, RR
Skaggs Island	San Pablo Bay	CD, HD
Praxis/Pacheco	Suisun Bay	CD, RR
Cargill Salt Div - 1 (West)	San Pablo Bay	HD
Hamilton Antenna N Field	San Pablo Bay	HD
Redwood Landfill	San Pablo Bay	LF
Cullinan Ranch	San Pablo Bay	HD
Port Sonoma-Marin	San Pablo Bay	RR
Sonoma Baylands	San Pablo Bay	HD
Leonard Ranch	San Pablo Bay	RR
Montezuma Wetlands	Suisun Bay	HD
Montezuma Cut	Suisun Bay	RR

Notes:

1. These are sites currently being studied. This list does not represent a ranking order.
2. Disposal Option Key
CD - Confined disposal
HD - Habitat development
LF - Landfill cover, liner, cap
RR - Rehandling/Reprocessing

Source:

Moffatt & Nichol, Engineers 1993.

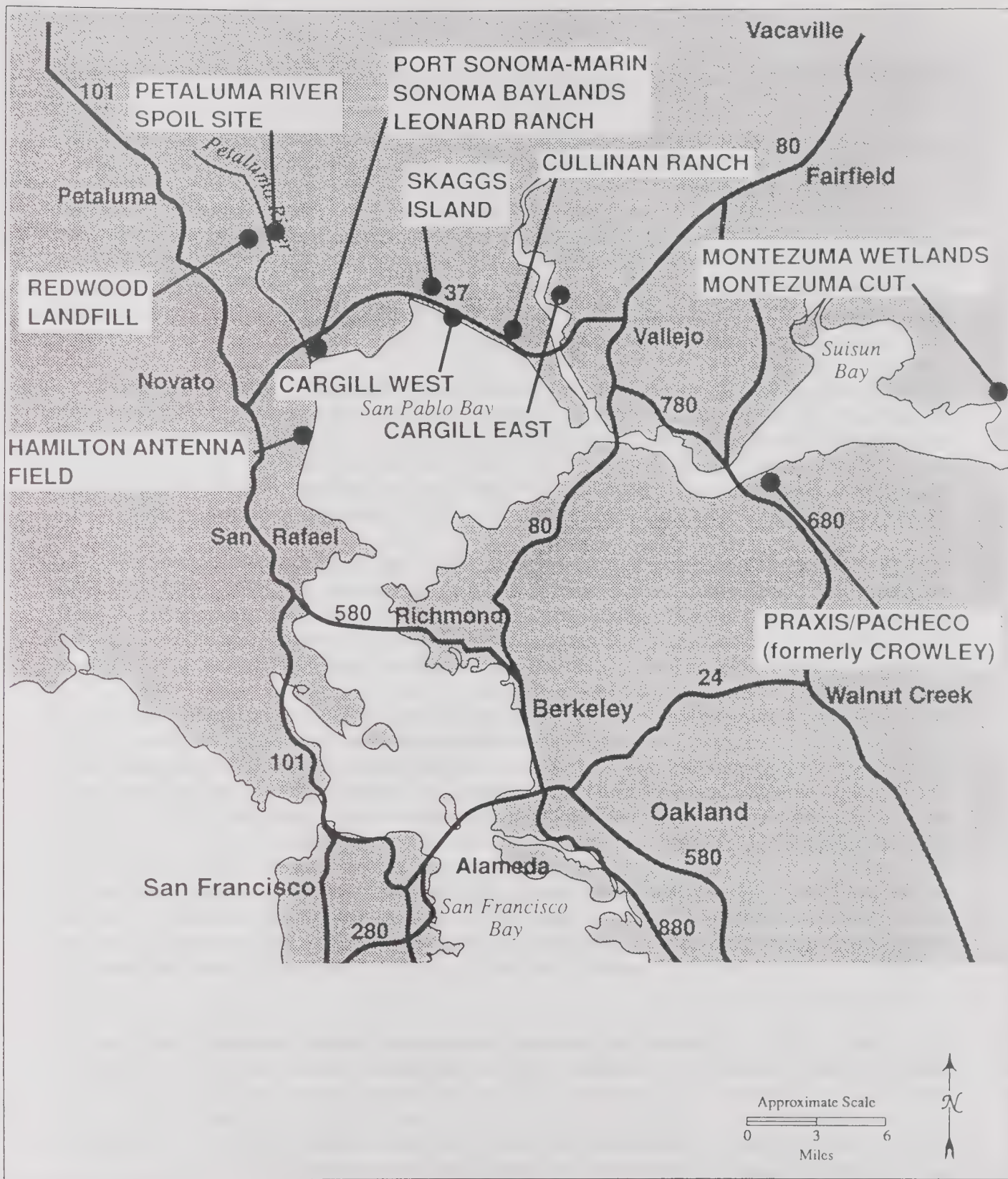


Figure 10.1-1

HIGHLY FEASIBLE LTMS UPLAND DISPOSAL SITES

10.2 LOCAL CONSIDERATIONS

10.2.1 Oakland Harbor

In addition to the proposed Deep-Draft Navigation Improvement Project, the following projects are being proposed to improve maritime and non-maritime operations within the Port of Oakland boundaries.

Howard Terminal. The existing one-stage gate facility has been upgraded to a two-stage gate to increase on-terminal queuing capacity and allow quicker truck processing time.

The project includes the construction of a maintenance/repair building and the provision of additional parking, container spaces, and new/improved cranes. These improvements are categorically exempt from the California Environmental Quality Act (CEQA).

Other improvements include possible modifications to the Jefferson Street access and the extension of Wharf 67 and 68. An EIR is being prepared to evaluate the impacts of these improvements.

Berth 30. This project, which was completed in January 1994, consists of the redevelopment of 55 acres at the entrance of the Seventh Street Terminal Complex in the Outer Harbor. The project involves the construction of a new container terminal, relocation of a portion of Seventh Street, extensions of the Matson Terminal Wharf and Berth 26, relocation of Port View Park, and provision of a waterfront pathway. The EIR for this project was certified and the project approved in 1991.

Joint Intermodal Terminal. Approximately 170 acres of the existing 200+ acre Southern Pacific West Oakland Rail Yard is proposed to be used to construct an intermodal terminal for consolidated use by multiple railroads. All existing track and buildings on the 170 acres would be removed. Four double working tracks would be constructed and the area paved as necessary. The existing rail classification tracks on the adjacent 30 acres would be preserved and may be available for use. The type of environmental document required for this project has not yet been determined.

Amtrak Intermodal Passenger Station and Related Facilities. The proposed project would consist of a 20,000-square-foot intermodal passenger station for rail and bus passengers, boarding platform, and related facilities together with track, signal, and roadway improvements for the Embarcadero and the rail corridor. The project would be located at Jack London Square. A mitigated Negative Declaration for this project was certified in 1992.

Naval Supply Center. Approximately 80 acres will be developed for intermodal/warehousing/ container storage with the potential for development of up to 400 additional acres, depending on base reuse decisions.

Rehabilitation of the Cargo Yards of Berths 8 and 9. This project, which is slated for construction in 1994, consists of various improvements to utilities and railroad tracks.

Caltrans Cypress Project. This project, scheduled to start construction in 1994, will reconstruct a link in the freeway system that connects the East Bay with the San Francisco-Oakland Bay Bridge, I-80 to the north, and other intra- and inter-regional destinations.

Middle Harbor Road. Middle Harbor Road will be improved to provide a more direct truck route between the Inner and Outer Harbor terminals and to reduce truck traffic on 7th Street.

In the City of Oakland beyond Port boundaries, no major development projects are proposed that are likely to result in significant cumulative impacts in conjunction with the proposed Port improvements (Raud 1993). A Super K-Mart retail project is proposed for East 8th Street at Alameda Avenue. This project has been processed with a negative declaration. Work has begun on replacement of the elevated Cypress structure, destroyed by the Loma Prieta earthquake. Construction should be completed by the year 2000.

In the City of Emeryville north of Port boundaries, no development projects are pending along the waterfront. A high-rise elderly care facility is proposed on the peninsula west of I-880. East of I-880, Kaiser Permanente Medical Center and Chiron Corporation are proposing projects involving 1.5 million square feet each. Draft EIRs on these projects are expected to be completed in February and March 1994 (Quinn 1993). These projects are not expected to result in significant cumulative impacts in conjunction with the proposed Port improvements.

Cumulative impacts include impacts from the proposed project as well as an increase in the West Coast market share of intermodal cargo east of the Mississippi and Texas. This increase is reflected by the potential for one additional vessel per week and would not result in cumulative marine transportation impacts. Ships calling at the Port of Oakland would be larger and/or more heavily loaded, resulting in increased loading and unloading activity levels while ships are in berth. The number of containers handled in a given period of time is expected to increase, as would the associated truck and rail activities. Traffic forecasts are based on year 2000 projections made by the Alameda County Transportation Model. Neither the proposed project, nor cumulative impacts of other Port improvements in conjunction with proposed development projects in the vicinity, would result in significant traffic impacts (see section 4.8.3.1). In part, this is because the Cypress replacement project will ultimately remove trucks and other vehicular traffic from many surface streets. Traffic mitigation during reconstruction of the Cypress Structure is described in the EIR/EIS dated September 1991. The number of trains operating is not likely to change from current levels as a result of the proposed project. Cumulatively, there may be an additional three trains per day, however the significance of this impact would depend upon the time of day that the trains are scheduled. The secondary impacts of increased employment in the surrounding area are likely to be widely diffused throughout the central Bay Area, and would not result in a significant transportation impact.

No potential cumulative noise or air quality impacts have been identified from landside developments. The area around the Port of Oakland project area is predominately industrial. Existing noise sources in this area include industrial facilities and aircraft overflights from the Alameda Naval Air Station located south of the Inner Harbor channel. Because of the insignificant contribution of marine and truck traffic associated with the proposed project to background noise in the area, no significant cumulative increase in noise levels is expected. Major sources of air pollutants in the vicinity include numerous sources within the Alameda Naval Air Station, container handling, marine transport, and vehicular sources. Since the proposed project's contributions to air emissions in the area is far less than the significance thresholds and because there would not be any significant cumulative impacts from traffic, it is not expected that there would be any significant cumulative air quality impacts related to the proposed project.

Cumulative Impacts

Water quality impacts associated with future maintenance dredging of the Oakland Harbor will be localized and short term, dissipating rapidly once dredging is completed. Maintenance dredging will affect water quality by temporarily increasing the suspended sediment load and decreasing dissolved oxygen levels; however, the magnitude of short-term impacts associated with maintenance dredging will either be equal to or less than those expected to occur at the dredging site for the proposed project. Impacts are not expected to be additive due to the temporary nature of the adverse but insignificant impacts. As shown in section 4.2.6.1, data are available that show total suspended solids concentrations will be low (i.e., 500 mg/L or less using a clamshell dredge) in the vicinity of the dredging operation, and dilution at the dredging site will occur quickly. As such, dissolved oxygen concentrations will rebound and substantial releases of contaminants are not expected; consequently, significant impacts to the water column at the dredging site are not expected.

Future maintenance dredging projects will remove those sediments that have accumulated in channels and along berths improved during the course of this project. Potential impacts to sediment quality are the same as those described in section 4.3.3.1 for the proposed dredging site. Impacts are not expected to be additive because maintenance dredging either maintains present sediment quality conditions at the dredging site or improves sediment quality if recently deposited sediments have become contaminated; therefore, adverse impacts to sediment quality at the dredging site are not expected.

Impacts to the biological community associated with future maintenance dredging projects within Oakland Harbor are expected to be localized and short term. Impacts would be of a similar nature to those described for this deepening project, although are expected to be of a lesser magnitude. Although the benthic organisms will be removed in areas where dredging occurred, the community present is unstable and consists of species tolerant of disturbance. Therefore, recovery of the current benthic community following completion of dredging activities is expected to be complete. Because suspension of sediments during dredging is expected to be short term, physical and toxic effects of increased suspended particulates on plankton, benthic invertebrates, and fish are not expected to be significant, provided dredging is avoided in areas where spawning is occurring. The dredging activities may temporarily affect the use of the area as a foraging site for fish, marine mammals, and birds, which would likely avoid the area and forage in other areas. Toxicity or bioaccumulation effects associated with sediment-borne contaminants are expected to be insignificant.

10.2.2 Disposal Options Included in the Selected Plan

Ocean Section 102 site. The principal cumulative development that would affect the Ocean Section 102 site is EPA's proposed designation of a deep-water ocean site at this location for disposal of dredged material as part of the LTMS for San Francisco Bay (EPA 1993a). Once designated, the proposed site would provide a disposal option for an estimated 6 mcy per year of dredged material over a 50-year period (a total of 300 mcy of sediment over the 50-year period). This site would be designated by EPA through a formal rulemaking process, currently expected to be completed in June 1994. The following summary of environmental impacts associated with use of this site for the 50-year period is from the the Final Environmental Impact Statement prepared for the designation of this site (EPA 1993a).

Cumulative air quality impacts from the project would be similar to those identified in section 4.1.4.1. Project emissions would be spread over a large portion of the Bay Area region between Oakland Harbor and offshore waters. Since these emission sources would be mobile, their impact, in combination with emissions from any reasonably foreseeable future source, would not be large enough in a localized area

significance thresholds, cumulative air quality impacts from the project would be significant.

The Final EIS for 102 Site designation concluded impacts to water quality are expected to be transitory and insignificant. The transitory nature of water column impacts would preclude additive effects. The water quality model for sediment dispersion predicted a low probability that fine-grained sediments would reach the boundary of any of the National Marine Sanctuaries following disposal at the Section 102 site. Moreover, dispersion modelling must be performed by each dredging proponent to determine if the disposal of dredged material for which a median lethal concentration (LC50) has been calculated in the suspended phase toxicity test is in compliance with established Implementation Manual criteria for open ocean disposal. The model simulates the initial phases of dredged material disposal and provides information on potential water column impacts by comparing concentrations of dredged material in the water column to 1 percent of the LC50 concentration. Only dredged material that meets all applicable water quality criteria will be placed at the Ocean Section 102 site; therefore, impacts on water quality would not be significant.

A sediment deposition model prepared by the EPA (1993) predicted that deposits (of a silt-clay mixture) with thicknesses greater than or equal to 10 cm would cover areas less than 10 square kilometers after one year of disposal activity. At no time would layers exceeding 10 cm be deposited instantaneously. Over time, a low-sloping mound will develop if material placement barges target the same point of release. Depending on the characteristics of the dredged material, significant localized changes in the grain size of the bottom sediments would be expected in areas with the highest deposition. Significant impacts on sediment quality are not expected because all sediments placed at the Ocean Section 102 site must be sampled and tested in compliance with the EPA and Corps dredged material evaluation guidelines of the MPRSA.

Cumulative impacts from various dredging projects on the biological community at the Ocean Section 102 site would vary depending on the volume of material disposed and the frequency at which material is disposed at the site. The disposal would primarily affect the benthic community (and their predators such as various epifauna and fish), specifically where depositional thickness are equal to or greater than 10 cm. In areas where depositional thicknesses are less than 10 cm, effects of smothering and changes in grain size and other sediment characteristics are expected to be minimal. Impacts are also not expected to be substantial since diversity and abundances of the various organisms found at the Ocean Section 102 site are relatively low. Effects on water column organisms such as plankton, fish, and marine mammals, would be temporary and are not expected to be significant. Potential impacts on marine birds and threatened and endangered species are expected to be insignificant. Toxic effects caused by contaminants associated with the dredged material are not expected to be an issue since only material determined to be suitable for unconfined aquatic disposal (based on EPA and Corps testing criteria) will be disposed at the site.

No cultural resources are known within the proposed ocean site. The project would therefore not contribute to cumulative impacts on cultural resources.

Noise impacts are typically confined to the relatively immediate vicinity of a project site. No significant cumulative noise impacts would occur, because the projects considered in the cumulative analysis are well removed from the proposed ocean disposal site.

Use of the ocean disposal site would result in negligible impacts on recreational or commercial fishing;

Cumulative Impacts

use of this site would thus not result in a cumulatively significant impact on these resources.

The proposed ocean site is located outside designated commercial vessel traffic lanes and away from any restricted passage areas, precautionary zones, or anchorages for commercial shipping. Other projects considered in the cumulative analysis are located well away from this site; therefore, it is not anticipated that cumulative impacts to marine transportation would occur.

Sonoma Baylands. The Sonoma Baylands site is one of the highly feasible upland disposal sites identified in the LTMS process described above. In addition to Sonoma Baylands, other dredged material disposal sites north of San Pablo Bay in Sonoma County include Port Sonoma-Marin, the Petaluma River disposal Site, Skaggs Island, and Sonoma Baylands. Both Port Sonoma-Marin and the Petaluma River disposal sites are existing reprocessing facilities. Skaggs Island and Sonoma Baylands are proposed sites. About 3,300 acres of Skaggs Island would be restored from hayfields to their former salt marsh habitat and seasonal wetlands under a proposal by the U.S. Fish and Wildlife Service to expand the San Pablo Bay National Wildlife Refuge. As described in this report, tidal restoration is proposed for 297 acres of the 348-acre Sonoma Baylands site.

Other potential disposal sites north of San Pablo Bay include Cargill East (Crystallizer Ponds) and Cargill West (Evaporator Ponds) in Napa County, and Cullinan Ranch in Solano County. About 425 acres of the Crystallizer Ponds are being considered for potential confined disposal of dredged material. Approximately 1,100 to 3,600 acres of the Evaporator Ponds could use dredged material to enhance wetland values. The 1,500-acre Cullinan Ranch is currently under study as a habitat restoration site by the U.S. Fish and Wildlife Service. It has not yet been determined whether dredged material would be used in the restoration project (Maiss 1993).

Northwest of San Pablo Bay in Marin County, the existing Redwood Sanitary Landfill is under consideration as a disposal site for dredged materials as part of an expansion project currently undergoing environmental review.

Potential cumulative impacts associated with the Sonoma Baylands site are related to the modifications to wildlife habitat. The replacement of 56.3 acres of existing seasonal freshwater and brackish wetlands with 289 acres of saltmarsh wetlands would mitigate impacts on wetlands to an insignificant level. No potential cumulative impacts related to transportation, noise, air quality, or land use have been identified.

No ground transportation is expected for dredged material moved from the Port of Oakland to the Sonoma Baylands site since this will occur by barge and pipeline. No related cumulative navigation traffic, noise, or air quality impacts are predicted for this portion of the proposed project.

As noted previously, the proposed project could contribute incrementally to reductions in productive agricultural land. However, none of the upland disposal sites has high quality agricultural soil, there would be no reduction of prime agricultural lands.

Galbraith Golf Course. The following projects are proposed in the vicinity of Galbraith Golf Course but are unrelated to the proposed Deep-Draft Navigation Improvement Project:

- *2002 Airport Development Program.* This long-term program consists of a multi-faceted group of airport improvement projects which the Port of Oakland proposes to implement

by the year 2002. The purpose is to increase the Metropolitan Oakland International Airport's capability to serve population centers in the East Bay and to meet global trade needs, particularly among Pacific Rim countries. The program involves terminal expansion, landside access, airline and airfield support improvements, air cargo and airfield development, and wetlands restoration. An EIR/EIS is currently in preparation, with completion of the Final EIR/EIS projected for November 1994.

- *Airport Ground Transportation Projects.* Other projects are underway, or are expected to be developed concurrently with the 2002 Airport Development Program, but involve separate EIR/EIS assessments. They include the BART-Oakland Airport Intermodal Connector Project from the Coliseum Station; the Airport Roadway Project to upgrade airport area roadways; I-880 Interchanges at Hegenberger Road and 98th Avenue; Route 61; the I-880 Intermodal Corridor Study; and the AC Transit Corridor Study.

In the City of Oakland beyond Port boundaries and west of I-880, a "big-box retail" project is proposed on Oakport Street between Hassler Way and 66th Avenue, approximately 2 miles north of Galbraith Golf Course. An EIR is being prepared for this project (Raud 1993).

In the City of San Leandro south of Galbraith Golf Course a recycling and resource recovery center is proposed adjacent to the wastewater treatment plant on Davis Street. The center is expected to be operational in 1994. In addition, the East Bay Regional Park District is in the process of improving Oyster Bay Regional Shoreline southwest of the golf course. Other projects that have been informally proposed in the vicinity of the golf course are not being actively processed because of slow economic conditions.

The movement of dredged materials to Galbraith Golf Course would not affect the ground transportation or water navigation systems since dredged material would be transported through a pipeline. The transport of levee material to the site would generate truck traffic. The designated truck routes, Doolittle Drive and Hegenberger Road, have adequate capacity to handle the expected low increase in traffic and thus no project-related transportation impacts are anticipated. If construction on the Airport Roadway Project noted above coincides with the transport of levee material, short-term cumulative construction traffic impacts could occur during a 4-month period. Construction schedules have not yet been specified, however, and no cumulative transportation impacts can be predicted with certainty at this time. No cumulative transportation-related noise or air quality impacts have been identified.

Potential project-related noise impacts on biological resources could occur if the noise from the unloader and booster pump exceeds recommended levels. If mitigation measures specified in this report are implemented, however, there would be no project-related or cumulative impacts on biological resources.

Use of the Galbraith Golf Course site would result in the temporary closure of the golf course, but an improved golf course would ultimately be reconstructed at this site. Disposal at this site would therefore not result in a cumulative loss of recreational lands, and would simultaneously provide for the proper closure of the landfill that lies beneath the golf course.

Port/Landfill. This option would not result in significant cumulative impacts in combination with the other development projects described above.

Cumulative Impacts

11.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF
MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT
OF LONG-TERM PRODUCTIVITY

Implementation of the proposed deepening project would result in both short- and long-term impacts. Dredging would temporarily increase air pollution emissions and noise in the immediate vicinity of the excavation; the air quality impacts would be significant and would last for up to two years. The transport of the dredged material and disposal of the material at the approved disposal site(s) would increase maritime traffic for the duration of the dredging period. Depending on the selected disposal site, there would be approximately 2,280 barge trips in transit during this period (assuming each barge could hold 2,500 cy of sediment) and the dredge and barges would be anchored in Oakland Harbor for the duration of dredging. If the project duration is two years, three barges per day would be towed by a tug boat across the Bay. This level of additional traffic would have only minimal impacts on shipping lanes in the San Francisco Bay Area, and any impacts would be short term.

Aquatic or upland disposal of the dredged materials would also result in short- and long-term environmental impacts. Disposal at an aquatic site would temporarily increase suspended solids concentrations and dissolved constituents, act as a deterrent for nektonic marine organisms, and to some degree modify the bottom topography. Placement of the sediments for restoration of wetland habitat would permanently modify land uses and topography. Creation of 289 acres of tidal wetland habitat at Sonoma Baylands with dredged sediments would be considered a beneficial project impact. This restoration project will increase the total acreage of tidal marshlands in the San Francisco Bay Area by approximately 1 percent. Both aquatic and upland disposal could potentially result in a long-term release of any contaminants contained within the sediments to groundwater and surface water resources, and in the case of aquatic disposal, to the surrounding aquatic environment. However, in the case of upland disposal, appropriate management and facility design would reduce impacts to surface water and groundwater to an insignificant level. Except for the Galbraith Golf Course site, all of the upland sites considered are underlain by brackish groundwaters, unsuitable for drinking and agricultural uses. At the Galbraith Golf Course site, wells screened within fresher water are contaminated with solvents and are otherwise unsuitable for drinking purposes. Upland disposal would be accompanied by long-term monitoring of water resources beneath and adjacent to the placement site, allowing for early detection of resource contamination. Contingency measures would be triggered at specific concentration levels should significant contamination of surface or groundwater resources occur. Contingency measures and the specific concentration levels triggering those mechanisms would be established by the facility's operating permits. In addition, control measures addressing potential exceedances of surface and groundwater standards will be incorporated into site management and design. Use of the Galbraith site for sediment disposal would preclude use of the existing golf course on this site for up to 7 years. This is considered a significant recreational impact that cannot be mitigated since nearby golf courses are all operating at capacity and cannot absorb additional players.

The tradeoff for the potential environmental impacts that are not offset by environmental gains is the socioeconomic gain of maintaining the Port of Oakland and the San Francisco Bay Area as a major import and export center on the West Coast. The shipping activities in the Port of Oakland result in tens of thousands of jobs and billions of dollars of trade with Pacific Rim nations and across the United States. The project area is a natural harbor that has undergone successive development over the past 100 years to become one of the largest containership terminals in the world. Past and future maintenance and new

Short-Term Uses vs. Long-Term Productivity

1 dredging projects in the Bay Area are predicated on the current needs for safe navigation and for
2 maintenance of the economic and social advantages of waterborne commerce. The improvement and
3 maintenance of dredging practices of the past have resulted in limited, largely short-term environmental
4 consequences.

5
6 The long-term implications of the proposed project are significant in terms of economic viability. The
7 long-term environmental consequences of the project are considered minimal on a regional level.

12.0 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES
THAT WOULD OCCUR IF THE PROPOSED ACTION IS IMPLEMENTED

The proposed action for the project would be the Selected Plan, Alternative B2, which includes three or four disposal sites: the ocean site, Sonoma Baylands, Galbraith Golf Course and, if required, the Port/Landfill option.

The proposed project would involve two types of resources: (1) general industrial resources including capital, labor, fuels, and construction materials; and (2) project-specific resources such as biotic resources, water resources, and land uses at the disposal site(s). The industrial resources would not be retrievable if the project is constructed.

Irreversible environmental changes would be realized both at the proposed dredging area and the approved disposal site(s). Benthic organisms living in the materials removed by dredge in Oakland Harbor would be destroyed by dredging activities. Although evidence indicates that benthic recolonization does take place at sites that are dredged regularly, constant disturbance tends to result in colonization by more opportunistic species, thus changing the nature of the distribution and diversity of species. Since the project area already is dredged annually for maintenance purposes, the bottom materials are already occupied by hardy species. Some of the channel bottom would be changed from soft mud to sands by the exposure of the top of the Merritt Formation. However, the Merritt sands are expected to be covered by the natural sedimentation of finer-grained material.

Similar disturbance of benthic communities would occur at the aquatic disposal sites which, under Alternative B2, would be the ocean site. Continued disposal of dredged materials at an aquatic site would modify or preclude recolonization of the site to its previously undisturbed state, and would change sediment characteristics, including grain size, at the disposal site. However, the ocean site is currently being used for dredged material disposal, so benthic community changes are already occurring there.

Placement of sediments at an upland site would eliminate existing uses, and existing habitat would be modified to create aquatic environments and biotic communities similar to those occurring in natural wetland habitats. Use of Sonoma Baylands would return this site to a tidal marsh. Use of the Galbraith site would temporarily eliminate existing recreational uses (the golf course and a soccer field).

13.0 PUBLIC INVOLVEMENT AND INTERAGENCY COORDINATION

13.1 PUBLIC INVOLVEMENT

Public comment on the proposed project was solicited pursuant to federal and state requirements. A state Notice of Preparation (NOP) was issued on June 25, 1991 and a federal Notice of Intent (NOI) published in the *Federal Register* on June 27, 1991, which identified four potential disposal sites: the Ocean Section 102 site, confined aquatic disposal at the Bay Farm Borrow Area offshore the City of Alameda, wetland restoration at Sonoma Baylands in Sonoma County, and Port of Oakland property in the City of Oakland currently occupied by the Lew F. Galbraith Golf Course. Following distribution of the NOP and NOI, two public scoping meetings were held on August 7 and 8, 1991, to receive agency and public comments regarding the proposed project.

Subsequent to the meetings, two additional disposal site options were formulated for dredged material disposal: drying of the dredged material on the Leonard Ranch property in Sonoma County, with ultimate use of the material at nearby landfills for capping or cover material; and fill for wetland restoration in Solano County as part of the Montezuma Wetlands Project. In response to these project alternative modifications, a Supplemental NOP (SNOP) and Supplemental NOI (SNOI) were published in December 30, 1992, and public comments solicited.

A third project modification was developed after issuance of the SNOP and SNOI. This was an alternative dredged material disposal option for drying up to 100,000 cy of sediments at the Port of Oakland Ninth Avenue Terminal that may be considered unsuitable for unconfined upland disposal by the RWQCB. After drying, the sediments would be transported by truck or train to a landfill for confinement or use as daily cover. Potential landfills and mode of transport included: West Contra Costa Sanitary Landfill (Class III) in Richmond, Contra Costa County (by truck); BFI Vasco Road Sanitary Landfill (Class III) in Livermore, Alameda County (by truck); and East Carbon Development Corporation (Class II), near East Carbon, Carbon County, Utah (by rail). A second SNOP was issued in June 1993 to solicit public comments on this additional dredged material disposal option.

Together, the NOP, NOI, SNOI, and SNOPs address all components and alternatives in the current project description and considered in this SEIR/S. Public concerns identified in the NOI and NOP processes and at the scoping meetings noted above focus on the disposal of the dredged material and include the following.

Dredging Activity

- Resuspension of toxic contaminants in the sediments into shallow Bay waters
- Impacts on nearby nesting areas of the California least tern, an endangered species

Aquatic and Upland Dredged Material Disposal

- Cumulative impacts of the proposed project with the projects encompassed by the interagency LTMS for dredging and disposal in the Bay Area over the next 50 years
- The breadth of the alternatives evaluated in depth, and why certain alternatives were eliminated from further consideration in the environmental review process

- Sediment suitability for various uses
- Socioeconomic impacts (e.g., impacts on commercial and recreational fisheries)

Aquatic Dredged Material Disposal

- Impacts of ocean disposal
- Impacts of in-Bay disposal
- Water quality impacts (acute, chronic, and sublethal)
- Impacts on aquatic resources (e.g., bioaccumulation and biomagnification through the food chain; chronic, sublethal, and delayed sublethal effects from contaminated dredge material)

Upland Dredged Material Disposal

- Water quality impacts
- Wetland impacts
- Traffic and air quality impacts
- Other terrestrial impacts
- Impacts of contaminated material (e.g., containment of contaminants; responsibility for management of disposal sites)
- Limitations on the capacity of disposal sites
- Temporary loss of recreational opportunities
- Loss of open space

A 45-day public review/comment period on the Draft SEIR/S began on March 18, 1994, the day the document was filed with the EPA. This comment period ended on May 2, 1994. Approximately 1,600 Notices of Availability of the Draft SEIR/S and 300 copies of the draft document were mailed to federal, state, and local agencies, as well as other organizations, businesses, and individuals.

Appendix M both summarizes and provides detailed information on the Draft SEIR/S comment activity. Appendix N responds to the comments on the Draft SEIR/S.

Approximately 1,600 Notices of Availability of the Final SEIR/S and 300 copies of the final document have been mailed to federal, state, and local agencies, other organizations, businesses, and individuals.

13.2 INTERAGENCY COORDINATION

The Corps and Port of Oakland have made numerous efforts to coordinate the development of this project with other agencies, including the Environmental Protection Agency, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), the State Resources Agency, the California Department of Fish and Game, the Regional Water Quality Control Board (RWQCB), the Bay Conservation and Development Commission, the State Lands Commission, the Coastal Conservancy, and other agencies. These coordination efforts have involved discussions, meetings, and correspondence on primarily the following issues: air quality, biological resources, cultural resources, sediment testing and resulting suitability determinations for various disposal options and uses, and water quality.

1 Development of the air quality analysis in this document has been coordinated with staff of the Bay Area
2 Air Quality Management District (BAAQMD). The analysis of the project's conformity with Section
3 176(c) of the Clean Air Act has been coordinated with staff of both the EPA and the BAAQMD.
4

5 The USFWS's Revised Draft Coordination Act Report (DCAR) for the project was received on February
6 14, 1994. Appendix H contains the Service's recommendations related to the project as contained in the
7 DCAR, as well as the Corps' response to those recommendations. The full text of the DCAR is not
8 included in Appendix H because of its volume (over 300 pages), much of which contains information that
9 is redundant with information in this SEIR/S. As detailed in Appendix H, the USFWS will provide the
10 final CAR on or before August 15, 1994.
11

12 The USFWS' updated list of proposed and listed threatened and endangered species that may occur in
13 the project area is provided in Appendix C in its entirety. The USFWS, by letter dated May 19, 1994,
14 concurred with the Corps' Biological Assessment that the Oakland Harbor recommended plan is not likely
15 to adversely affect federally listed, threatened, and endangered species. This list was received too late
16 to confirm the presence of some of the species at Montezuma Wetlands that did not appear on previous
17 lists. The presence of these species at this site will be confirmed and addressed in the Montezuma
18 Wetlands Project EIR/S.
19

20 The Corps initiated coordination with the State Historic Preservation Officer (SHPO) with regard to
21 cultural resources that may be present in the project area. By letter dated June 7, 1994, the SHPO
22 concurs with the Corps' determination that there are no historic properties within the Area of Potential
23 Effect (APE) and, accordingly, the Corps has met its responsibilities under Section 106 of the National
24 Historic Preservation Act.
25

26 The Corps and Port of Oakland have coordinated and consulted with agencies that commented on the
27 Draft SEIR/S, as well as the FAA.
28

29 The City of Oakland, East Bay Municipal Utility District (EBMUD), and Ransom-McKay, Inc. (the
30 operator of the Galbraith Golf Course) have an agreement (to the year 2008) that Galbraith Golf Course
31 will accept no less than 162 acre-feet and no more than 200 acre-feet of reclaimed water per year from
32 EBMUD. If the Ransom-McKay agreement with Oakland to operate the golf course is terminated prior
33 to July 1, 2002, the obligations of Ransom-McKay are assigned to Oakland. According to the
34 Memorandum of Understanding between the Port and City of Oakland, the Port will assume all of the
35 City of Oakland's responsibilities under the EBMUD agreement during the period between the date that
36 the Port takes possession of the Galbraith Golf Course through the date that the Port delivers possession
37 of the new golf course to Oakland. The Port is currently examining the feasibility of rerouting a portion
38 of the reclaimed water to irrigate the proposed containment berms or Port properties, such as Airport
39 Drive.
40

41 13.3 MEETINGS WITH THE OAKLAND COMMUNITY DEVELOPMENT DISTRICTS

42

43 The seven Oakland Community Development Districts are mechanisms for community input and control
44 of the City of Oakland's Community Development Block Grant program. The Port's Director of
45 Governmental Affairs and Environmental Manager participated in a variety of community meetings to
46 discuss, early on, the Port's consideration of Galbraith as a disposal site. The following is a chronology
47 of meetings attended where the Port representatives made presentations regarding the harbor deepening

Public Involvement and Interagency Coordination

1 project and possible disposal of the dredged material at the Galbraith site. Community members were
2 invited to comment on the proposed project, and invited to participate in the SEIR/S process.

3
4 November 25, 1991 North Oakland Community Development District Meeting -- Port presentation on
5 dredging and Galbraith disposal as an alternative.

6
7 June 4, 1992 A Council of Seven Community Development District Chairs Meeting -- Report
8 on the Mayor's Port/City Task Force and the 42-Foot Project.

9
10 June 22, 1992 North Oakland Community Development District Meeting -- Governmental
11 Affairs presentation on the status of 42-Foot Project, including the Galbraith
12 disposal option.

13
14 July 9, 1992 Chinatown/Central Community Development District Meeting -- Presentation by
15 Governmental Affairs staff on Port, dredging, and a follow-up letter with
16 additional information on the sediment chemistry and biological testing and on
17 Galbraith disposal alternative.

18
19 July 15, 1992 Central East Oakland Community Development District Meeting -- Presentation
20 on Port/City Task Force, dredging and Galbraith.

21
22 July 20, 1992 Elmhurst Community Development District Meeting -- Report on Port dredging
23 and potential disposal at Galbraith.

24
25 October 19, 1992 Elmhurst Community Development District Meeting -- Follow-up report to this
26 meeting specifically on Galbraith.

27
28 October 21, 1992 Central East Oakland Community Development District Meeting -- Presentation
29 on dredging project and Galbraith disposal alternative under consideration.

30
31 December 22, 1992 Follow-up letters to the seven Community Development Districts regarding the
32 results of the Port's equal opportunity program and offering to make additional
33 presentations to each of the seven boards.

34
35 The Oakland Community Development Districts also received the Notice of Availability of the Draft
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